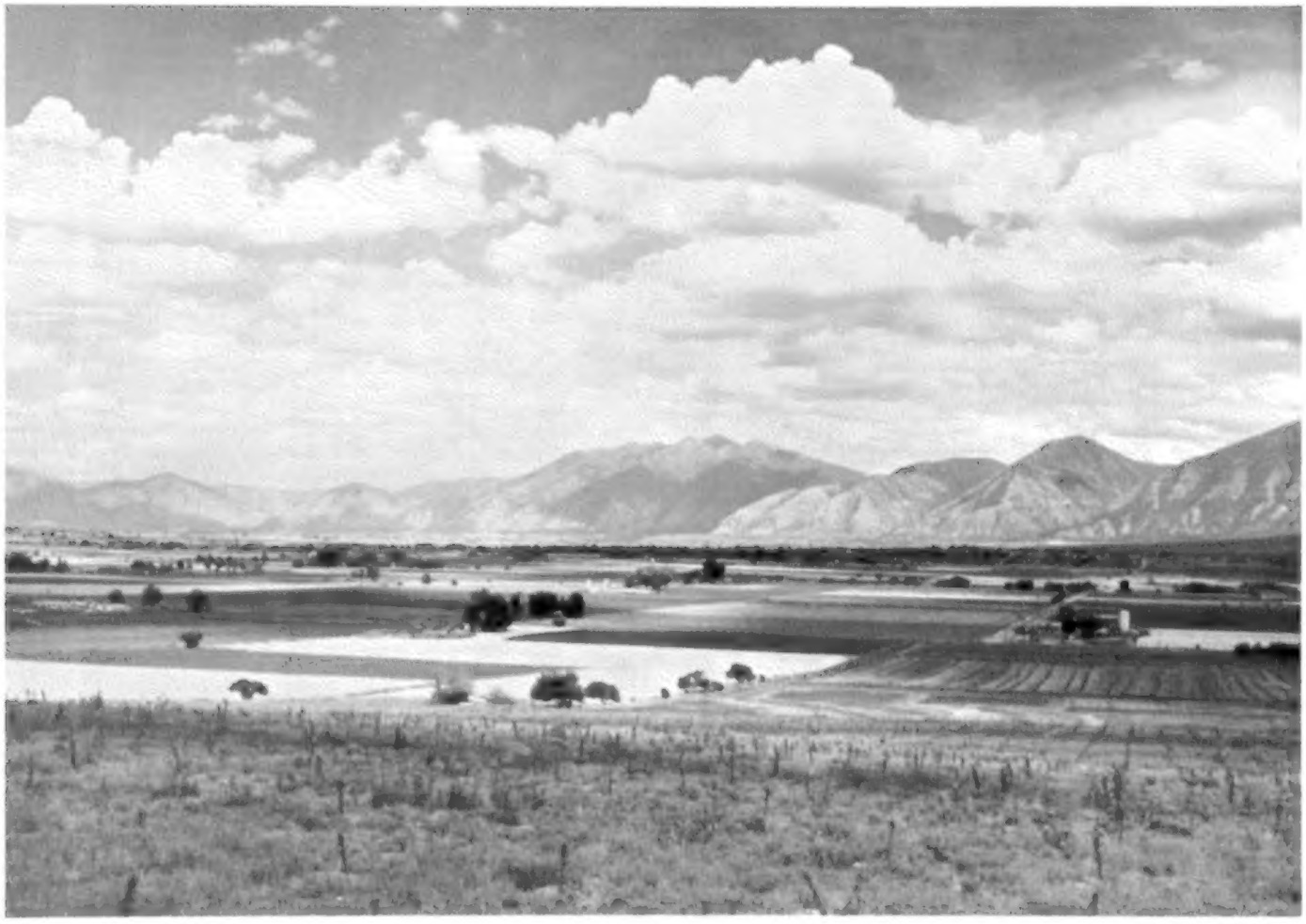
SOIL SURVEY OF
UTAH COUNTY, Utah
CENTRAL PART



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Utah Agricultural Experiment Station

Issued January 1972

Major fieldwork for this soil survey was done in the period 1962-66. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1963. This survey was made cooperatively by the Soil Conservation Service and the Utah Agricultural Experiment Station. It is part of the technical assistance furnished to the Alpine and Nebo Soil Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All of the soils in the area surveyed are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils in the survey area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil and each capability unit is described.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of Soils for Wildlife."

Engineers and builders can find, under "Engineering Applications," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in this part of Utah County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Facts About the Area."

Cover Picture:

An area of Utah Valley. The new orchard in the foreground is on a Pleasant Grove gravelly loam. The nearly level soils in the center foreground are in the Bramwell and Taylorsville series.

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SOIL SURVEY OF UTAH COUNTY, UTAH: CENTRAL PART

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH UTAH AGRICULTURAL EXPERIMENT STATION

UTAH COUNTY: CENTRAL PART (fig. 1), covers an

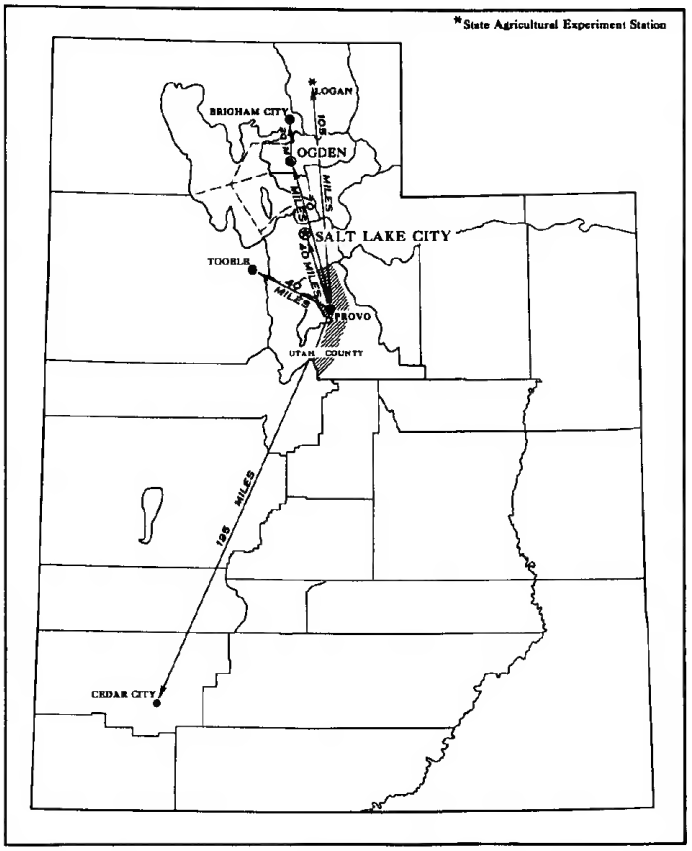

Figure 1.--Location of Utah County: Central Part, in Utah.

area of about 206,504 acres, or about 323 square miles. It extends from the Juab County line on the south to the Salt Lake County line on the north, and from West Mountain and Utah Lake on the west to the Wasatch Mountain on the east.

This survey area is mainly irrigated cropland but some wet areas are used for pasture and wildlife. Some areas on the northern and southern borders and a narrow strip on the eastern side of the survey area are used for range.

Elevations range from 4,400 feet on the shores of Utah Lake to about 7,000 feet on the Traverse Mountain, but most of the area surveyed is at elevations between 4,500 to 5,100 feet.

Provo, at the base of the Wasatch Mountain and the county seat, is near the center of the survey area. It had a population of 37,000 in 1960. Other communities that have a population of 2,000 or more are American Fork, Lehi, Payson, Pleasant Grove, Spanish Fork, and Springville.

Many of the topographic features of this survey area reflect the influence of ancient Lake Bonneville. The low lake terraces, or lake plains, are in the bottom of the valley near the shores of Utah Lake. The soils in these areas are used mainly for truck crops, sugar beets, small grains, and pasture.

The rivers and streams, such as the Spanish Fork River and Dry Creek, have built nearly level to gently sloping flood plains and alluvial fans on the low lake terraces. The soils in these areas are used for alfalfa, small grains, corn, and sugar beets.

The higher terraces, or benches, were built by rivers and streams that entered ancient Lake Bonneville. These areas are 200 to 300 feet higher than Utah Lake. The soils on these benches are especially important for the production of fruit, but they are also used for general farming.

Above the highest terraces of Lake Bonneville there are some strongly sloping to steep alluvial fans that formed before and during the Lake Bonneville period. Typically, however, the topography consists of steep and very steep soils on hillsides.

Most of the alfalfa, grain, and corn ensilage produced in the survey area is fed to feeder beef cattle and lambs or to dairy herds. The dryland farms that are used for crops are mainly west of the town of Alpine, but some are south of the town of Salem and of Santaquin city.

The principal industry in the survey area is steel and cast iron manufacturing; the Geneva Steel and the Pacific States Cast Iron Pipe are the main plants.

HOW THIS SURVEY WAS MADE

Soil scientists made this survey to learn what kinds of soils are in this survey area where they are located, and how they can be used. The soil scientists went into the survey area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories of soil classification most used in a local survey (12)1/.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Pleasant Grove and Timpanogos, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Pleasant Grove gravelly loam, 3 to 6 percent slopes, is one of several phases within the Pleasant Grove.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of this survey area: soil complexes and soil associations.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Provo-Sunset complex is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Picayune-Rake association, 35 to 70 percent slopes, eroded, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Cobbly alluvial land is a land type in this survey area.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

Only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultations. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

1/ Underscored numbers in parentheses refer to Literature Cited, page 157.

GENERAL SOIL MAP

The general soil map at the back of this survey shows, in color, the soil associations in this survey area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in locating sites for engineering works and recreational facilities, and for community developments. It is not suitable for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The 12 soil associations in this survey area are discussed in the following pages. The terms for texture used in the title of an association apply to the surface layer of the major soils in the association. For more detailed information about the individual soils in each association, refer to the detailed map and to the section "Descriptions of the Soils."

1. Chipman-McBeth Association

Poorly drained, nearly level, loamy soils on low lake terraces

This association occurs on low lake terraces, mainly north and east of Utah Lake and in a small area north of Payson city. It consists of dark-gray or black, poorly drained, nearly level soils.

This association makes up about 14 percent of the survey area. It is about 40 percent Chipman soils and 20 percent McBeth soils. The remaining 30 percent is Holdaway, Logan, Peteetneet, Provo Bay, and other minor soils.

The Chipman soils are poorly drained and have a silty clay loam surface layer and whitish, calcareous layers. The McBeth soils are poorly drained and have silt loam texture.

The minor Holdaway and Provo Bay soils, each make up about 10 percent of the association. They are poorly drained. The Holdaway soils have a lime cemented hardpan, and the Provo Bay soils are very highly calcareous. The Logan and Peteetneet soils together make up about 15 percent of the association. The Peteetneet soils consist of peat and muck. In the vicinity of Vineyard, they occur in the marshy, seep areas and are surrounded by Holdaway soils. The Logan soils are very poorly drained and typically occupy areas near Utah Lake. Other minor soils are the Bramwell and Ironton.

The soils in this association are highly fertile, have high organic-matter content, absorb water readily, and are easy to till. Permeability is slow to rapid, and the available water capacity is high. These soils are wet and cold, and they are slow to warm in spring. Small spots are moderately saline.

In this association elevations range from 4,485 to 4,600 feet. The climate is dry subhumid. The average annual precipitation ranges from 12 to 16 inches, and the mean annual temperature is 47° to 50° F. The frost-free period is 130 to 150 days.

Most areas are used for truck crops, sugar beets, small grains, and alfalfa. The Logan and Peteetneet soils are used mainly for range and wildlife habitat.

Farms in this association are generally no more than 100 acres in size. Some farms are exclusively truck farms, but some are used for truck crops and general farm crops. The wet soils are used for pasture and hay for dairy and beef cattle.

Drainage and efficient use of irrigation water are important concerns of management.

2. Payson-Logan, Heavy Variant-Arave Association

Moderately well drained to poorly drained, nearly level, mainly saline-alkali, loamy and clayey soils on low lake terraces

This association is on low lake terraces, mainly north of the Lehi pumping plant and south of Lincoln Beach near Utah Lake. It also occurs as small areas north of the Geneva Plant of the U.S. Steel Company and between the cities of Springville and Spanish Fork, and it occupies a small area north of the town of Salem. The soils are dark grayish brown to black, moderately well drained to poorly drained, nearly level, and mainly saline-alkali.

This association makes up about 3 percent of the survey area. It is about 30 percent Payson soils, 25 percent Logan soils, heavy variant, and 20 percent Arave soils. The remaining 25 percent is Jordan soils, Mixed alluvial land, saline, and other minor soils.

The Payson soils are moderately well drained. They are slightly saline-alkali in the surface layer but are strongly saline-alkali at a depth of more than 20 inches. The Logan soils are poorly drained and moderately saline. They have a black, calcareous surface layer 16 to 18 inches thick and a subsoil of silty clay or silty clay loam. The Arave soils occur mainly in the valley bottoms, south of Lincoln Beach. They are poorly drained, strongly saline-alkali, and have a dark grayish-brown or dark-gray surface layer and a silty clay loam subsoil.

The minor Jordan soils make up about 10 percent of the association. They are moderately saline-alkali in the surface layer but are strongly and very strongly saline below a depth of about 9 inches. Mixed alluvial land, saline, consists of very salty soil material of variable texture, and it has a crust of salt on the surface. This land and other minor soils make up about 15 percent of the association.

The soils in this association are slowly or very slowly permeable. Runoff is slow or very slow, and water ponds in places. The vegetation consists only of plants that are tolerant of salt or alkali.

Elevations range from 4,485 to 4,600 feet. The climate is dry subhumid. The average annual precipitation ranges from 10 to 14 inches, and the mean annual temperature ranges from 47° to 50° F. The frost-free period is 130 to 150 days.

Except for some of the Payson soils, the soils of this association generally are not suited to cultivated crops. In some areas the Payson soils have been reclaimed and are used for improved pasture, alfalfa, and small grains, but yields are generally low. The Arave, Logan, and Jordan soils have limited use as pasture; pasture of tall wheatgrass has been established in places.

3. Taylorsville-Welby Association

Well-drained, nearly level to moderately steep, loamy soils on intermediate lake terraces

This association consists of dark grayish-brown to dark-brown, well-drained, nearly level to moderately steep soils on intermediate lake terraces. The larger areas are in the vicinity of Lehi city and of Payson city.

This association makes up about 10 percent of the survey area. It is about 35 percent Taylorsville soils and 30 percent Welby soils. The remaining 35 percent is Bramwell and Vineyard soils.

The Taylorsville and Welby soils occupy the upper parts of lake terraces. The Taylorsville soils have a moderately calcareous silty clay loam surface layer and strongly calcareous silty clay loam underlying layers. The Welby soils are similar to the Taylorsville soils except that they have light silt loam texture.

The minor Bramwell soils are somewhat poorly drained and occur on slightly lower parts of the lake terraces than the major soils. They are moderately saline-alkali; about half of their acreage has been drained and reclaimed. The Vineyard soils have also been improved by drainage and reclamation, but in about 30 percent of the acreage they are moderately saline.

The major soils are moderately fertile. The Taylorsville soils are slowly permeable and somewhat difficult to till. The Welby soils are moderately permeable and easy to till.

Elevations range from 4,490 to 4,700 feet. The climate is dry subhumid. The average annual precipitation ranges from 14 to 16 inches, and the mean annual temperature is 47° to 50° F. The frost-free period is 130 to 150 days.

The Taylorsville and Welby soils and the nonsaline areas of the Bramwell and Vineyard soils are used for alfalfa, small grains, corn, sugar beets, and pasture. The saline Bramwell and Vineyard soils are used mainly for native or improved pasture, but alfalfa and small grains are grown in places; yields are usually low.

Drainage generally is the most needed practice in areas of the Bramwell and the Vineyard soils to avoid compaction. The Taylorsville and Bramwell soils should be tilled when they are not too wet. Land leveling, for even distribution of irrigation water, is needed on all of these soils.

The farms in this association are comparatively large, and livestock feed is the main crop.

4. Pleasant Vale-Kirkham-Sunset Association

Well-drained and somewhat poorly drained, nearly level to gently sloping, loamy soils on flood plains

This association occurs mainly on flood plains that extend from Spanish Fork city west to Beer Creek. It also occupies a small area south of Lehi city. The soils are dark brown to very dark grayish brown, well drained and somewhat poorly drained, and nearly level to gently sloping.

This association makes up about 12 percent of the survey area. It is about 75 percent Pleasant Vale, Kirkham, and Sunset soils that are almost equal in extent. The remaining 25 percent is mainly Benjamin, Martini, and Redola soils.

The Pleasant Vale soils are well drained and have a loam surface layer. The Kirkham and Sunset soils are on the flood plain of Dry Creek, south of Lehi city. The Kirkham soils are somewhat poorly drained and have a silty clay loam surface layer. The moderately well drained Sunset soils have a loam surface layer.

The Pleasant Vale and Sunset soils are moderately to highly fertile, moderately permeable, and easy to till. The Kirkham soils are slowly permeable and require timely tillage at a proper moisture content.

Elevations range from 4,500 to 4,700 feet. The climate is dry subhumid. The average annual precipitation is 13 to 16 inches, and the mean annual temperature ranges from 47° to 50° F. The frost-free period is 130 to 150 days.

The farms in this association range from 100 to 300 acres in size. Crops are alfalfa, small grains, corn, sugar beets, and pasture plants. Except for sugar beets, most of the crops are fed locally to livestock.

Drainage and efficient use of irrigation water are important management practices.

5. Steed-Pleasant Vale-Redola Association

Well-drained, nearly level to gently sloping, gravelly, loamy soils on flood plains and alluvial fans

This association is on flood plains near the mouth of canyons; the larger areas are on bottom land along the Provo River near American Fork city and are in the vicinity of Santaquin city. The soils are dark brown to very dark brown, well drained, and nearly level to gently sloping.

This association makes up about 7 percent of the survey area. It is about 70 percent Steed, Pleasant Vale, and Redola soils that are equal in extent. The remaining 30 percent is Keigley, Pleasant View, and Provo soils.

The major soils in this association are well drained. Permeability is moderately slow to rapid. The Steed soils are near the stream channels. They have a gravelly sandy loam surface layer and are underlain by very gravelly loamy sand. Fertility and the available water capacity are low. The Pleasant Vale soils occur on the low part of fans and on flood plains. They have a loam surface layer and are underlain by loam and very fine sandy loam. Fertility is moderate, and the available water capacity is high. The Redola soils have loam texture. Fertility and the available water capacity are high. The Steed soils are fairly difficult to till because of the gravel content. The Pleasant Vale and Redola soils are easy to till.

The minor soils in this association are about equal in extent. The Provo soils are poorly drained and are mottled at a depth of less than 30 inches. The Keigley and Pleasant View soils are well drained. The Keigley soils occur with the Pleasant Vale soils.

Elevations range from 4,500 to 5,200 feet. The climate is dry subhumid. The average annual precipitation ranges from 14 to 16 inches, and the mean annual temperature is 47° to 50° F. The frost-free period is 130 to 150 days.

Alfalfa, small grains, tree fruits, and corn are grown in this association. A few new apple orchards are being planted in the area north of Santaquin. Many of the cities and towns in the survey area are in this association. The farms are generally 10 to 40 acres in size. The efficient use of irrigation water and proper tillage of the gravelly soils are important concerns of management.

6. Benjamin-Kirkham Association

Somewhat poorly drained, nearly level, saline-alkali, clayey and loamy soils on flood plains and alluvial fans

This association is at the edge of the flood plain of the Spanish Fork River; the largest area is north and east of the town of Palmyra. The soils are dark brown to very dark grayish brown, somewhat poorly drained, and nearly level.

This association makes up about 3 percent of the survey area. It is about 75 percent Benjamin soils and 20 percent Kirkham soils. The remaining 5 percent is Mixed alluvial land, saline.

The Benjamin and Kirkham soils are somewhat poorly drained and moderately or strongly saline-alkali. These soils compact easily if tilled when too wet. The Benjamin soils have a silty clay surface layer, and the Kirkham soils have a silty clay loam surface layer. The strongly saline-alkali Benjamin and Kirkham soils are low in fertility, but the moderately saline-alkali soils are moderately fertile.

Mixed alluvial land, saline, generally has 2 percent or more salt within 20 inches of the surface.

Elevations are 4,500 or 4,600 feet. The climate is dry subhumid. The average annual precipitation ranges from 13 to 16 inches, and the mean annual temperature is 47° to 50° F. The frost-free period is 130 to 150 days.

Most of this association is used for pasture. In places small grains and alfalfa are grown on the moderately saline-alkali soils, but yields are generally low.

7. Bingham-Parleys Association

Well-drained, nearly level to moderately sloping, gravelly, loamy soils on intermediate and high lake terraces

This association is on broad lake terraces known locally as the Highland, Orem, and Mapleton Benches. It consists of dark-brown to very dark grayish-brown, well-drained, nearly level to moderately sloping soils.

This association makes up about 14 percent of the survey area. It is about 50 percent Bingham soils and 20 percent Parleys soils. The remaining 30 percent is minor soils, mainly Timpanogos, Kidman, Dagor, and Hillfield.

The Bingham soils consist of gravelly or cobbly heavy loam or sandy clay loam to a depth of about 20 inches, and they are very gravelly and sandy below. They occur near the mouth of the canyons on the upper part of lake terraces. The Parleys soils have a loam or silty clay loam surface layer and a silty clay loam subsoil. The major soils developed in lake-laid sediments of gravelly loamy sand to silty clay loam texture.

The Parleys soils are friable, absorb water readily, and have high available water capacity. The Bingham soils are gravelly, fairly difficult to till, and have low available water capacity. Permeability is moderately slow to rapid in both soils.

The minor soils in this association are well drained.

Elevations range from 4,700 to 5,200 feet. The climate is dry subhumid. The average annual precipitation ranges from 14 to 18 inches, and the mean annual temperature is 49° to 52° F. The frost-free period is 150 to 170 days.

The soils in this association are used extensively for irrigated crops, alfalfa, corn, small grains, sugar beets, and tomatoes. Peach, cherry,

apple, and pear orchards are also important on the Bingham soils. Most of the farms are irrigated and average 50 to 100 acres in size.

Land leveling to a uniform grade for even distribution of irrigation water is an important management practice on the nearly level to gently sloping soils. Controlling erosion is the principal concern of management on the moderately sloping soils.

8. Pleasant Grove-Cleverly-Kilburn Association

Well-drained, gently sloping to steep, gravelly or stony, loamy soils on intermediate and high lake terraces

This association occurs mainly as a narrow strip on alluvial fans and colluvial slopes along the foothills. The larger areas are in the vicinity of Pleasant Grove and Alpine. The soils are dark-brown to very dark grayish-brown, well drained to somewhat excessively drained, and gently sloping to steep.

This association makes up about 10 percent of the survey area. It is about 50 percent Pleasant Grove soils, 20 percent Cleverly soils, and 20 percent Kilburn soils. The remaining 10 percent is mainly Pleasant View and Dagor soils.

The Pleasant Grove soils are strongly calcareous and have a surface layer of gravelly loam or stony loam. They formed in alluvium derived from limestone. The Cleverly soils are noncalcareous or slightly calcareous. They have a surface layer of gravelly fine sandy loam. The Kilburn soils have a surface layer of very gravelly sandy loam. The Cleverly and Kilburn soils formed in alluvium derived mainly from quartzite.

The major soils in this association are moderately fertile and moderately rapid to rapidly permeable. They are fairly difficult to till and have low to moderate available water capacity because they are gravelly or cobbly.

Elevations range from 4,600 to 5,700 feet. The climate is dry subhumid. The average annual precipitation ranges from 14 to 18 inches, and the mean annual temperature is 49° to 52° F. The frost-free period is 150 to 170 days.

The soils in this association are used for irrigated farming, for community developments, range, pasture, watersheds, and wildlife habitat. Most areas used for range are not irrigated. The irrigated soils are used mainly for peach, cherry, pear, and apple orchards.

The farms in this association consist mainly of small orchards that average about 30 acres in size.

9. Lakewin-Layton Association

Well drained and moderately well drained, nearly level to moderately steep, gravelly, sandy, and loamy soils on lake terraces and terrace escarpments

This association is in the western half of the survey area. One of the largest areas is east of the Geneva Steel plant. The soils are dark brown to very dark grayish brown, well drained and moderately well drained, and nearly level to moderately steep.

This association makes up about 5 percent of the survey area. It is about 45 percent Lakewin soils and 35 percent Layton soils. The remaining 20 percent is mainly Preston and Bramwell soils.

The Lakewin soils are well drained and have gravelly fine sandy loam texture to a depth of 20 inches and very gravelly loamy sand texture below. The Layton soils are well drained or moderately well drained. They have a loamy fine sand or fine sandy loam surface layer and are underlain by loamy fine sand. Their surface layer and the layer below are calcareous; a white, calcareous layer is at a depth of more than 25 to 35 inches. The water table is between a depth of 36 and 60 inches in the moderately well drained Layton soil. The Lakewin and Layton soils developed in lake sediments, some of which have been extensively reworked by wind.

The major soils are low to moderately fertile, droughty, and have low available water capacity. Permeability is rapid. The hazard of soil blowing is severe on the sandy soils if they are left bare.

Elevations range from 4,500 to 5,200 feet. The climate is dry subhumid. The average annual precipitation ranges from 14 to 18 inches, and the mean annual temperature is 47° to 52° F. The frost-free period is 130 to 170 days.

This association is used for irrigated crops and for community development. The irrigated soils are used mainly for peach, cherry, apple, and pear orchards. Some vineyards are on the Preston soils, but many areas are idle or are used for limited range. Crops grown on the moderately well drained Layton soils are alfalfa, small grains, and corn. Sprinkler irrigation is better suited to these sandy, droughty soils than are other methods of irrigation.

10. Welby-Hillfield Association

Well-drained, gently sloping to steep, loamy soils on high lake terraces

This association occurs mainly near the towns of Alpine and Salem, but it is also in small areas on the Mapleton and Orem Benches. The soils are brown to very dark grayish brown, well drained, and gently sloping to steep.

This association makes up about 9 percent of the survey area. It is about 55 percent Welby soils and 25 percent Hillfield soils. The remaining 20 percent is Taylorsville and McMurdie soils.

The Welby soils occur in swales and on slopes that generally face north and east. They have a surface layer of dark-brown silt loam. The Hillfield soils occupy ridges, steeper slopes, and slopes that face south and west. Their surface layer is dark grayish-brown silt loam.

The soils in this association are low to moderately fertile, firm to friable, and have high available water capacity. The Welby and Hillfield soils are moderately permeable and are easy to till.

Elevations range from 4,700 to 5,200 feet. The climate is dry subhumid. The average annual precipitation ranges from 12 to 18 inches, and the mean annual temperature is 49° to 52° F. The frost-free period is 150 to 170 days.

The soils in this association are used mainly for dryland wheat and alfalfa. Some areas are used for range, and a few areas are used for irrigated alfalfa, small grains, and corn.

11. Henefer-Manila-Dry Creek Association

Well-drained, moderately sloping to very steep soils that have a clayey subsoil; mainly on mountains

This association is on mountains and alluvial fans. It occurs on the Traverse Mountain, in Pole Creek Canyon, and in an area south of the Goose Nest. It consists of dark-brown to very dark grayish-brown, well-drained, moderately sloping to steep soils that are gravelly or cobbly in some places.

This association makes up about 7 percent of the survey area. It is about 40 percent Henefer soils, 20 percent Manila soils, and 20 percent Dry Creek soils. The remaining 20 percent is mainly Gappmayer and McPhie soils.

The Henefer soils are mainly on the Traverse Mountain and in the steeper areas of Payson and Pole Creek Canyons. They have a surface layer of loam and a subsoil of cobbly clay. The Manila soils occur mainly on alluvial fans, and they have a subsoil of clay. The Dry Creek soils are on old alluvial fans and hillsides. They have a cobbly clay subsoil and are strongly calcareous.

The very steep Gappmayer soils occur on mountains, mainly near the Dream Mine and on Loafer Mountain. The McPhie soils are on slopes that face north and east in the higher parts of the Traverse Mountain and are associated with the Henefer soils.

The major soils in this association are those that formed in alluvium or colluvium weathered from mixed sedimentary rocks. These soils are moderately to highly fertile, and they absorb water readily. Permeability is slow to rapid, and the available water capacity is moderate to high.

Elevations range from 5,200 to 7,000 feet. The climate is moist subhumid. The average annual precipitation ranges from 16 to 25 inches, and the mean annual temperature is 45° to 47° F. The frost-free period ranges from 80 to 150 days.

The soils in this association are used mainly as range for sheep and cattle in spring and fall. They are important for use as wildlife habitat and as watersheds.

12. Rake-Picayune Association

Well-drained, steep and very steep, stony and cobbly, loamy soils on hillsides and mountains

This association occurs on mountains and on hillsides, mainly in Pole Creek and Payson Canyons. It consists of dark-brown to very dark brown, well-drained, steep and very steep soils.

This association makes up about 6 percent of the survey area. It is about 55 percent Rake soils and 30 percent Picayune soils. The remaining 15 percent is Picayune soils, red variant, and Rock land.

The Rake soils are on slopes that face south and west. They have a surface layer of extremely stony loam and a subsoil of cobbly clay loam. A lime cemented hardpan is within 20 inches of the surface. The Picayune soils occur on slopes facing north and east and in areas at higher elevations than the Rake soils. The Picayune soils have a surface layer of cobbly silt loam or loam and a subsoil of cobbly silty clay loam.

The major soils in this association developed in colluvium or local alluvium derived from limestone. They are moderately fertile. The Rake soils have low available water capacity. Permeability is slow or very slow in the hardpan. The Picayune soils have high available water capacity. Permeability is moderate.

Elevations range from 5,200 to 7,000 feet. The climate ranges from dry subhumid to moist subhumid. The average annual precipitation ranges from 16 to 25 inches, and the mean annual temperature is 45° to 49° F. The frost-free period ranges from 80 to 150 days.

This association is used mainly as range for sheep and cattle in spring and fall. It is also important for use as habitat for wildlife and as watersheds.

This section explains the system of capability classification used by the Soil Conservation Service and the system adapted by the State of Utah and used locally. It discusses uses of the soils for irrigated crops and for irrigated and dryland pasture and range and gives estimated yields of the principal crops, pasture, and fruit trees grown in the survey area. It also includes a discussion of the use of soils for wildlife and for building roads, ponds, and other engineering works.

In presenting information about the use of soils for crops and pasture and for wildlife habitat, the procedure is to describe a group that is made up of similar soils that are suitable for those purposes and to suggest use and management for the group. In the section on engineering, the soils are not grouped but are placed in tables so that properties significant to engineering work can be readily given.

Crops and Pasture

Some practices are beneficial if applied to most of the soils used for irrigated crops and pasture. These practices are discussed here briefly to avoid repetition.

An important management requirement is the safe and uniform distribution of irrigation water. Both the border and furrow methods are suitable for hay, pasture, and small grains, and the furrow system is also suitable for row crops. Sprinklers are a suitable alternative for most crops. Losses of soil and water can be held to a minimum by using proper lengths of runs and sizes of flows in furrows and borders. Some soils, such as the Hillfield and Taylorsville, are particularly subject to damage by irrigation water if it is not properly controlled.

Because of the beneficial effect on soil structure, the return of organic matter is particularly important in soils that are irrigated. Sources of organic matter are crop residue, barnyard manure, and the sod crops grown in the cropping system. Practices that provide for regular additions of organic matter are ordinarily the most beneficial. The use of fertilizer in amounts sufficient to produce large increases in plant growth makes it possible to return increased amounts of organic matter to the soil.

The low content of organic matter in the Taylorsville, Hillfield, and Welby soils in this survey area makes them especially susceptible to the formation of traffic pans. Good tilth can be maintained and the formation of traffic pans reduced, however, if the soils are not tilled or trampled when wet. The formation of traffic pans can also be reduced by varying the depth of tillage and limiting the number of trips over the soil with tillage equipment. These soils are particularly benefited by regular additions of organic material and commercial fertilizer.

Most of the soils in this survey area are well supplied with potassium, calcium, iron, and magnesium. In some soils calcium carbonate is so plentiful that it interferes with the absorption of iron by fruit trees and other plants and causes their leaves to turn yellow.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major, and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, e, w, s, or c, to the class numeral, for example, IIe. The letter e shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used in this survey area but not in some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by w, s, and c, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture or range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding Arabic numbers, or numbers and letters, assigned locally, to the subclass symbol, for example, IIe-2, IIIe-U, VIe-M, or VIIs-UX4. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter immediately following indicates the subclass, or kind of limitation, as defined in the foregoing paragraph. The part of the symbol following the hyphen specifically identifies the capability unit in the State system; they are not numbered consecutively.

In the Utah system of classification, a number or capital letters following the subclass letter is used to suggest the nature of the limitations. The Arabic numbers 1 or 2 in the first position show that the limitation is climate; number 1 indicates that the capability unit is made up of soils that occur in areas where the frost-free period is 150 to 190 days. Capability units that have Arabic numbers of 2 are in areas where the frost-free period is 100 to 150 days. The letters U and M are for dryland capability units and show the average annual precipitation. The letter U indicates that the average annual precipitation is 12 to 18 inches and M indicates that it is 18 to 25 inches or more. Additional numbers or letters indicate the following limitations: 2, flooding or inadequate surface drainage; 3, an inhibiting layer; 4, gravelly, cobbly, and stony soils that have low available water capacity; 5, slow permeability; 6, sandy soils that have low available water capacity; 7, salinity; 8, alkali or salinity and alkali; and X, coarse fragments on the surface.

Management by Capability Units

In this section each capability unit in the survey area is described and the use and management are briefly discussed. The names of soil series represented are mentioned in the capability unit, but this does not mean that all of the soils of a given series are in that unit. To find the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units," at the back of this survey.

The length of irrigation runs, size of streams, and the interval between irrigations that are given in the descriptions of the capability units are based on an irrigation efficiency of 65 to 70 percent and can be used to evaluate existing irrigation practices.

The soils have not been placed in range sites because range is not an important use in this survey area. Range use and management are discussed in capability classes V through VII in this section.

Capability Unit I-1, Irrigated

This capability unit consists of well drained and moderately well drained soils on lake terraces and alluvial fans. These soils are in the Dagor, Keigley, Kidman, Parleys, Pleasant Vale, Timpanogos, and Welby series. The surface layer and the underlying layers range from loam or very fine sandy loam to silty clay loam. These soils formed in mixed lake sediments and alluvium derived mainly from limestone, sandstone, quartzite, and granite. Slopes are 0 to 3 percent. Elevations range from about 4,700 to 5,200 feet. The frost-free period is 150 to 170 days. The average annual precipitation ranges from 14 to 16 inches.

Permeability is moderate to moderately slow. Runoff is slow, and the hazard of erosion is none to slight. These soils hold 7.5 to 12 inches of available water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet. The Timpanogos soil has a water table that fluctuates between depths of 40 and 60 inches.

The soils in this unit are used for irrigated small grains, alfalfa, sugar beets, corn, tomatoes, potatoes, orchards, and irrigated pasture. A suitable rotation is 4 years of alfalfa or pasture, or for at least one-fourth of the rotation; 1 year of barley for grain; 1 year of sugar beets; 1 year of corn for silage; and 1 year of barley for grain with alfalfa seeded in the stubble.

Good tilth is easily maintained by plowing in the fall, by returning organic matter to the soil, and by avoiding tilling or trampling when the soil is too wet. Except for legumes, all crops generally respond to additions of nitrogen fertilizer; all legumes respond to applications of phosphorus.

The furrow method of irrigation is well suited to row crops, and the border method is suitable for alfalfa and pasture. Sprinklers can be used satisfactorily.

These soils need about 5 inches of irrigation water every 17 to 20 days during the periods of maximum water use. Where row crops are grown on most of the soils having a slope of about 0.5 percent, water can be applied efficiently in 5 or 6 hours by using a flow of 1 cubic foot per second on 18 furrows 700 to 800 feet long. Where the border method is used, 5 inches of water can be applied in about 2 to 2 1/2 hours by using runs about 1,000 feet long and borders 40 to 70 feet wide and a flow of 1 cubic foot of water per second for each 12 feet of border width. Shorter runs or more furrows or borders are needed on the steeper slopes. Because the Parleys soils have a slower intake rate than the other soils, border irrigation on these soils require 3 1/2 to 4 hours; for furrows 1 cubic foot of water per second should be distributed in about 35 furrows.

Capability Unit IIe-1, Irrigated

This capability unit consists of well-drained soils on lake terraces and alluvial fans. These soils are in the Kidman, Parleys, Pleasant Vale, Timpanogos, and Welby series. The surface layer is very fine sandy loam, loam, or silt loam, and the underlying layers range from very fine sandy loam or loam to silty clay loam. The Pleasant Vale soils are gravelly. The soils in this unit formed in mixed lake sediments and alluvium derived mainly from limestone, sandstone, quartzite, and granite. Slopes are 1 to 6 percent. Elevations range from 4,700 to 5,200 feet. The frost-free period is 150 to 170 days, and the average annual precipitation ranges from 14 to 16 inches.

Permeability is moderate to moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. These soils hold 7.5 to 12 inches of available water to a depth of 5 feet. The effective root depth is 5 feet or more.

These soils are used for irrigated small grains, alfalfa, sugar beets, corn, and pasture. Sugar beets are not generally grown on the gravelly Pleasant Vale soils. A suitable rotation is 4 years of alfalfa or pasture, or for at least one-fourth of the rotation; 1 year of barley or grain; 1 year of sugar beets; 1 year of corn for grain or silage; and 1 year of barley for grain with alfalfa seeded in the stubble.

Good tilth can be maintained easily by plowing in the fall, by returning organic matter to the soil, and by avoiding tilling or trampling when the soil is too wet. Except for legumes, most crops respond to additions of nitrogen fertilizer; legumes respond to applications of phosphorus, which is usally applied when the alfalfa is seeded.

The furrow method of irrigation is well suited to row crops. The border method is suitable for alfalfa or pasture on slopes of less than 3 percent. Sprinklers can be used satisfactorily.

These soils need about 5 inches of irrigation water every 17 to 20 days in periods of maximum water use. Where row crops are grown on slopes of about 1.5 percent, 5 inches of water can be efficiently applied in 6 to 8 hours by using a flow of 1 cubic foot per second on 64 furrows 300 to 400 feet long. Where the border method is used, 5 inches of water can be applied in about 2 hours by using 1 cubic foot of water per second for each 20 feet of border width. Suitable runs are about 750 feet long, and borders are no wider than 40 feet. On slopes of about 3 percent, a flow of 1 cubic foot of water per second should be distributed in about 150 rows about 300 feet long.

Capability Unit IIe-2, Irrigated

This capability unit consists of well-drained soils on alluvial fans and flood plains. These soils are in the Keigley, Pleasant Vale, and Welby series. The surface layer and the underlying layers range from loam or very fine sandy loam to silty clay loam. These soils formed in alluvium derived from limestone, sandstone, and shale. Slopes are 1 to 3 percent. Elevations range from 4,485 to 4,700 feet. The frost-free period is 130 to 150 days, and the average annual precipitation ranges from 14 to 16 inches.

Permeability is moderate to moderately slow. Runoff is slow, and the hazard of erosion is slight. These soils hold 7.5 to 12 inches of available water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet.

These soils are used for irrigated small grains, alfalfa, sugar beets, corn for silage, and improved pasture.

A suitable rotation is 4 years of alfalfa or pasture, or for at least one-fourth of the rotation; 1 year of barley for grain; 1 year of sugar beets; 1 year of corn for silage; and 1 year of barley for grain with alfalfa seeded in the stubble.

Good tilth is easily maintained by plowing in the fall, by returning organic matter to the soil, and by avoiding tilling or trampling when the soils are too wet. Except for legumes, most crops respond to additions of nitrogen fertilizer; all legumes respond to applications of phosphorus.

The furrow method of irrigation is well suited to row crops, and the border method is suitable for alfalfa, small grains, and pasture. Sprinklers can be used satisfactorily.

These soils need about 5 inches of irrigation water about every 17 to 20 days in periods of maximum water use. On slopes that average about 1.5 percent, 5 inches of water can be efficiently applied to row crops in 11 to 12 hours by using a flow of 1 cubic foot per second in about 65 furrows 500

to 600 feet long. Where the border method is used, 5 inches of water can be applied in about 3 hours by using 1 cubic foot of water per second for each 20 feet of border width. Runs should be about 1,000 feet long and borders no more than 40 feet wide. Shorter runs or more furrows or borders are needed on the steeper slopes.

Capability Unit IIw-2, Irrigated

This capability unit consists of poorly drained, somewhat poorly drained, and moderately well drained soils on lake terraces, alluvial fans, and flood plains. These soils are in the Chipman, Ironton, Kirkham, Martini, McBeth, Sunset, and Vineyard series. The surface layer and the underlying layers range from loam or fine sandy loam to silty clay loam. These soils formed in mixed lake sediments and alluvium derived mainly from limestone, sandstone, shale, quartzite, and granite. Slopes are 0 to 2 percent. Elevations range from 4,485 to 4,600 feet. The frost-free period ranges from 130 to 150 days, and the average annual precipitation is 14 to 16 inches.

Permeability is rapid to moderately slow. Runoff is very slow to slow, and the hazard of erosion is none to slight. These soils hold 7.5 to 12 inches of water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet or to the water table. Depth to the water table ranges from 20 to 60 inches.

If these soils are drained, they are used mainly for irrigated small grains, pasture, sugar beets, corn, and alfalfa. Some areas are used for pasture of native grasses.

A suitable crop rotation is 4 years of alfalfa or pasture; 1 year of barley for grain; 1 year of sugar beets; 1 year of corn for silage; and 1 year of barley for grain with alfalfa seeded in the stubble.

Good tilth is easily maintained by plowing in the fall, by returning organic matter to the soil, and by avoiding tilling or trampling when the soils are too wet. Except for legumes, most crops respond to additions of nitrogen fertilizer; all legumes respond to applications of phosphorus.

The most important management practices are drainage and the control of the water table. Tile and open ditches are used for drainage. About 70 feet of tile, 5 or 6 feet deep, are needed per acre. Surface ditches help to dispose of surface water and to reduce ponding.

The furrow method of irrigation is well suited to row crops, and the border method is suitable for pasture or alfalfa.

The amount of water that plants obtain from the water table influences irrigation needs. Only enough water should be applied to satisfy the needs of the crop. Water applied in excess of crop requirements causes the water table to rise. Three inches of water per irrigation is generally enough to wet the soil to field capacity. On slopes that average about 1 percent, 3 inches of water can be applied efficiently to row crops in 3 or 4 hours by using a flow of 1 cubic foot per second for about 40 furrows 300 to 400 feet long.

Land leveling helps to even the distribution of water by eliminating low spots where water accumulates. If the calcareous subsoil is exposed in leveling, crop growth is reduced for several years unless manure and fertilizer are heavily applied.

Capability Unit IIc-2, Irrigated

This capability unit consists of well-drained soils on alluvial fans and flood plains. These soils are in the Keigley, Pleasant Vale, Redola, and Welby series. Their surface layer and underlying layers range from loam or very fine sandy loam to silty clay loam. These soils formed in alluvium derived mainly from limestone, sandstone, quartzite, and shale. Slopes are 0 to 3 percent. Elevations range from 4,485 to 4,700 feet. The frost-free period ranges from 130 to 150 days. The average annual precipitation is 14 to 16 inches.

Permeability is moderate to moderately slow. Runoff is slow, and the hazard of erosion is none to slight. The soil holds 7.5 to 11 inches of available water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet.

These soils are used for irrigated small grains, alfalfa, sugar beets, corn, tomatoes, potatoes, and pasture. They are not suitable for orchards because of the frost hazard.

A suitable crop rotation is 4 years of alfalfa or pasture, or for at least one-fourth of the rotation; 1 year of barley for grain; 1 year of sugar beets; 1 year of corn for silage; and 1 year of barley for grain with alfalfa seeded in the stubble.

Good tilth is easily maintained by plowing in the fall, by returning organic matter, and by avoiding tilling or trampling when the soils are too wet. Except for legumes, all crops generally respond to nitrogen fertilizer; all legumes respond to applications of phosphorus.

The furrow method of irrigation is well suited to row crops, the border method is suitable for alfalfa, pasture, or small grains. Sprinklers are also satisfactory.

The soils in this unit need about 5 inches of irrigation water every 13 to 15 days during the period of maximum water use. Where row crops are grown on slopes that average about 1 percent, 5 inches of water can be applied efficiently in about 7 hours by using a flow of 1 cubic foot per second in about 45 furrows 375 to 475 feet long. On slopes of about 0.5 percent, 5 inches of water can be applied in about 2 hours by using 1 cubic foot of water per second for each 12 feet of border width. Suitable borders are 850 to 1,000 feet long and no wider than 60 feet. Shorter runs or more furrows or borders are needed on steeper slopes.

Capability Unit IIIe-1, Irrigated

This capability unit consists of well-drained soils on lake terraces and alluvial fans. The soils

are in the Kidman, Parleys, Pleasant Vale, and Welby series. The surface layer is very fine sandy loam, gravelly loam, loam, or silt loam. The underlying layers range from very fine sandy loam or loam to silty clay loam. These soils formed in mixed lake sediments and alluvium derived from limestone, quartzite, sandstone, and granite. Slopes are 3 to 6 percent. Elevations range from 4,700 to 5,200 feet. The frost-free period ranges from 130 to 170 days but is mainly 150 to 170 days. The average annual precipitation is 14 to 16 inches.

Permeability is moderate to moderately slow. Runoff is medium, and the hazard of erosion is moderate. These soils hold 7.5 to 12 inches of available water to a depth of 5 feet. The effective root depth is 5 feet or more.

The Welby soil in this unit has only 130 to 150 frost-free days. Orchards are not generally grown on this soil, and the yield or quality of some other crops are reduced frequently by frosts.

The soils in this unit are used mainly for irrigated alfalfa, small grains, and alfalfa and grass grown for hay or pasture. They are fairly well suited to orchards. Slopes are too steep for row crops.

A suitable rotation is 4 years of alfalfa and smooth bromegrass for hay or pasture; 1 year of barley for grain; and 1 year of barley for grain, with alfalfa seeded in the barley stubble. Pasture or alfalfa should be grown for at least half of the rotation.

Improved pasture usually requires additions of nitrogen fertilizer every year and phosphorus every 2 to 4 years. Phosphorus generally is applied to alfalfa at seeding time. Orchards also respond well to nitrogen fertilizer.

Intensive control of irrigation water is necessary to control erosion where a gravity method of irrigation is used.

The soils in this unit need about 5 inches of irrigation water every 17 to 20 days during the period of maximum water use. Five inches of water can be applied efficiently by furrow irrigation in 8 or 9 hours on slopes of about 5 percent by using 1 cubic foot per second in about 200 furrows 200 feet long.

Capability Unit IIIe-14, Irrigated

This capability unit consists of well-drained soils of gravelly loam and gravelly fine sandy loam texture. These soils are in the Cleverly and Pleasant Grove series. They formed in alluvium or colluvium derived from limestone, quartzite, and sandstone on alluvial fans or colluvial slopes. Slopes are 6 to 15 percent. Elevations range from 4,700 to 5,300 feet. The frost-free period is 150 to 170 days. The average annual precipitation is 14 to 20 inches.

Permeability is moderately rapid to rapid. Runoff is medium, and the hazard of erosion is high. These soils hold 4 to 6 inches of available water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet.

These soils are used for irrigated crops, for nonirrigated alfalfa, and for community development. Under irrigation, these soils are suited to peach, cherry, pear, and apple orchards, to permanent pasture, or grass-legume hay.

A suitable rotation is 4 years of alfalfa or alfalfa and smooth bromegrass for hay or pasture; 1 year of barley for grain; and 1 year of barley for grain with alfalfa seeded in the barley stubble.

Erosion control, cultivation of the gravelly soils, and efficient use of irrigation water are the main concerns of management. The sprinkler method is the most suitable method of irrigation. Water can be applied at the rate of 0.4 to 0.7 inch per hour. These soils are subject to excessive loss of water by runoff or deep percolation.

These soils need about 3 inches of irrigation water every 10 or 11 days during the period of maximum water use. Where orchards are grown on 1.5 percent slopes, 3 inches of water can be applied fairly efficiently in 2 1/2 or 3 hours by using gradient furrows and a flow of 1 cubic foot per second in about 50 furrows 200 feet long. Gradient furrows are not generally efficient on slopes of more than 10 percent. Three inches of water can be applied efficiently to grass-legume hay or pasture in 1 hour by controlled flooding from contour ditches spaced 175 to 200 feet apart.

Nitrogen is the main fertilizer needed on orchards. At the start of the growing season it should be applied annually at the rate of 0.2 pound of available nitrogen per inch of tree diameter. Phosphorus fertilizer should be applied at the rate of 25 to 45 pounds per acre every 2 or 3 years. Applications of potassium fertilizer may give better color, especially to apples. Legume crops respond to applications of phosphorus every 2 or 3 years.

Growing cover crops in orchards and leaving all crop residue on the surface protects the soil against erosion.

Capability Unit IIIe-25, Irrigated

This capability unit consists of well-drained soils on lake terraces. These soils are in the Taylorsville series. They formed in lake sediments derived from limestone, sandstone, and shale. Their surface layer is silty clay loam. Slopes are 0 to 3 percent. Elevations range from 4,485 to 5,200 feet. The frost-free period ranges from 130 to 150 days in most areas, but it ranges from 150 to 170 days in areas of the Taylorsville silty clay loam, extended season. The average annual precipitation is 14 to 16 inches.

Permeability is slow. Runoff is slow, and the hazard of erosion is moderate. These soils hold about 11 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet.

Some apple orchards are grown in areas of Taylorsville silty clay loam, extended season, where the frost hazard is reduced.

These soils are used mainly for irrigated alfalfa, small grains, corn, sugar beets, and improved pasture.

A suitable crop rotation is 4 years of alfalfa or pasture, or for one-fourth of the rotation; 1 year of barley for grain; 1 year of sugar beets; 1 year of corn for silage; and 1 year of barley for grain with alfalfa seeded in the stubble.

Good tilth can be maintained if the soils are plowed in the fall, organic matter is returned to the soil, and the soils are not tilled or trampled when wet. Commercial fertilizers are usually needed in addition to manure and plant residue. Except for legumes, most crops respond to additions of nitrogen fertilizer; all legumes respond to applications of phosphorus.

The furrow method of irrigation is well suited to row crops, and the border method is well suited to alfalfa and pasture. Sprinklers can be used satisfactorily.

These soils need about 5 inches of irrigation water every 17 to 20 days during periods of maximum water use. Where row crops are grown on slopes of 1.5 percent, 5 inches of water can be applied efficiently in 21 hours by using a flow of 1 cubic foot per second in about 64 furrows 600 to 700 feet long. If the border method is used, 5 inches of water can be applied in about 5 hours by using a flow of 1 cubic foot per second for each 20 feet of border width. The borders should be about 875 feet long and 40 to 50 feet wide. The irrigation runs can be longer on Taylorsville silty clay loam, 0 to 1 percent slopes and on Taylorsville silty clay loam, extended season, 0 to 1 percent slopes. Where slopes average about 0.4 percent on these soils 5 inches of water can be applied efficiently to row crops in 11 to 12 hours by using a flow of 1 cubic foot per second on about 18 furrows 1,250 to 1,350 feet long. Five inches of water can be applied by the border system in about 8 hours by using a flow of 1 cubic foot per second for each 27 feet of border width. The borders should be about 1,320 feet long and no more than 60 feet wide.

Capability Unit IIIe-U, Nonirrigated

This capability unit consists of well-drained soils on alluvial fans and lake terraces. These soils are in the Dagor, Hillfield, McMurdie, Parleys, Redola, Taylorsville, Timpanogos, and Welby series. Their surface layer ranges from loam, silt loam or gravelly loam, to silty clay loam. The underlying layer ranges from loam to silty clay. The Redola soil has a gravelly surface layer 5 to 20 inches thick. All of the soils formed in mixed lake sediments and alluvium derived mainly from limestone, sandstone, quartzite, and granite. Slopes are 1 to 10 percent. Elevations are 4,500 to 5,200 feet. The frost-free period ranges from 130 to 170 days. The average annual precipitation is 14 to 20 inches.

Permeability is moderate to slow. Runoff is slow to medium, and the hazard of erosion is slight to severe. The soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet.

These soils are used mainly for dryland wheat or alfalfa. Small areas have been seeded to dryland grasses for pasture, and some areas are used for range.

These soils should be kept under a cover of grasses or legumes about half of the time to control erosion and to maintain the organic-matter content, tilth, and good intake characteristics. Practices that leave large amounts of crop residue on the surface should be used to reduce runoff and to help control erosion. Stubble mulching helps to maintain a protective cover on the surface.

Stripcropping at right angles to the wind are needed to reduce wind erosion in some areas. Stripcropping across the steeper slopes also is desirable for slowing runoff. Alternate strips of fallow-wheat and grass-legume are used.

Capability Unit IIIw-25, Irrigated

This capability unit consists of somewhat poorly drained and poorly drained soils on low lake terraces and flood plains. These soils are in the Benjamin, Bramwell, and Holdaway series. The surface layer and the underlying layers are silty clay or silty clay loam. These soils formed in mixed lake sediments and alluvium derived from limestone, shale, and sandstone. Slopes are 0 to 2 percent. Elevations are 4,500 to 4,600 feet. The frost-free period ranges from 130 to 150 days, and the average annual precipitation is 12 to 16 inches.

The Benjamin and Bramwell soils are slowly permeable. Runoff is slow, and the hazard of erosion is none to slight. These soils hold 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet or to the water table. Depth to the water table ranges from 30 to 60 inches.

The Holdaway soil is poorly drained and has a hardpan cemented with lime at some depth between 20 and 40 inches. Permeability is moderately slow above the hardpan. The soil holds about 8 inches of available water. Roots penetrate only to the hardpan.

If drained, these soils are used for irrigated small grains, improved pasture, sugar beets, corn, and alfalfa. Some areas are used for pasture of native grasses.

A suitable crop rotation is 4 years of alfalfa or pasture; 1 year of barley for grain; 1 year of sugar beets; 1 year of corn for silage; and 1 year of barley for grain with alfalfa seeded in the stubble.

Good tilth can be maintained by plowing in the fall, by returning organic matter to the soil, and by avoiding tilling or trampling when the soils are too wet. Generally, all crops except legumes, respond to additions of nitrogen fertilizer; all legumes respond to applications of phosphorus.

Drainage, controlling the water table, timely tillage, and land leveling are special concerns of management. Both tile and open drains are used. Blasting the hardpan to loosen it is sometimes necessary in the Holdaway soil. Generally, about 70

feet of drainage tile is needed per acre; the tile should be placed at a depth of about 5 or 6 feet. Disposal ditches to reduce ponding are helpful in some areas.

The furrow method of irrigation is well suited to row crops. The border method is suitable for pasture or alfalfa. The amount of water that plants obtain from the water table influences irrigation needs. Only enough water to satisfy the crop needs should be applied. Water applied in excess of crop requirements raises the water table. Five inches of water applied at each irrigation is generally enough to wet the soil to field capacity. Where row crops are grown on slopes of about 0.4 percent, 5 inches of water can be applied efficiently in 11 to 12 hours by using a flow of 1 cubic foot per second for about 22 furrows 1,100 to 1,200 feet long. If the border method is used, 5 inches of water can be applied in about 8 hours by using a flow of 1 cubic foot per second for each 25 feet of border width. The borders should be about 1,300 feet long and 50 to 60 feet wide.

Because of the hardpan, the irrigation needs of the Holdaway soil should be determined by testing each field. Land leveling provides for even applications of water by eliminating low spots where water accumulates, but deep cuts should be avoided on the Holdaway soil.

Capability Unit IIIw-27, Irrigated

This capability unit consists of poorly drained to moderately well drained, moderately saline soils on low lake terraces, alluvial fans, or flood plains. These soils are in the Bramwell, Chipman, Ironton, Kirkham, McBeth, Sunset, and Vineyard series. The Bramwell and Kirkham soils are moderately saline-alkali. The surface layer and the underlying layers range from fine sandy loam or loam to silty clay loam. These soils formed in mixed lake sediments and alluvium derived from limestone, sandstone, shale, quartzite, and granite. Slopes are 0 to 2 percent. Elevations range from 4,500 to 4,700 feet. The frost-free period ranges from 130 to 150 days. The average annual precipitation is 12 to 16 inches.

Permeability is slow to moderately rapid. Runoff is very slow to slow, and the hazard of erosion is none to slight. Depth to the water table is 20 to 40 inches. The available water is 8 to 12 inches to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet or to the water table. Because of the salt content, only about 6 to 9 inches of water is available to plants.

These soils are used for irrigated crops and native pasture. If drained but prior to reclamation, sugar beets and alfalfa can be grown, but when drained and reclaimed truck crops and corn can be grown. Undrained soils are better suited to irrigated grass-legume hay or pasture than to cultivated crops.

A suitable crop rotation in the drained and reclaimed areas is 4 years of alfalfa and grass for hay or pasture; 1 year of barley for grain; 1 year of sugar beets; 1 year of corn for silage; and 1 year of barley for grain with alfalfa seeded in the stubble.

Good tilth is easily maintained by plowing in the fall, by returning organic matter to the soil, and by avoiding tilling or trampling when the soils are too wet. Commercial fertilizers are usually needed in addition to manure and plant residue. Generally, all crops except legumes respond to additions of nitrogen fertilizer; all legumes respond to applications of phosphorus.

Drainage, control of the water table, and salt reduction are the main concerns of management. Both tile drains and open ditches can be used for drainage. About 70 feet of tile are needed per acre. Generally, the tile should be placed about 5 or 6 feet below the surface. During the initial reclamation after drainage, barley is grown for 3 years and all of the straw is plowed under. The content of salt can be reduced by a leaching irrigation; about 12 inches of water should be applied annually after the soil is plowed or after the fourth year of alfalfa.

The furrow method of irrigation is well suited to row crops. The border method is suitable for pasture, alfalfa, or small grain. The amount of water that plants obtain from the water table influences irrigation needs. Only enough water to satisfy the needs of crops should be applied. Water applied in excess of crop requirements raises the water table. Three inches of water applied at each irrigation is generally enough to wet the soil to field capacity. Where row crops are grown on slopes of about 1 percent, 3 inches of water can be applied efficiently in about 4 hours by using a flow of 1 cubic foot per second for about 45 furrows 300 to 400 feet long. The moderately saline-alkali Bramwell and Kirkham soils have a slower intake rate than the other soils in this unit. They require 8 or 9 irrigations using a flow of 1 cubic foot per second for about 45 furrows 475 to 575 feet long.

Land leveling facilitates uniform distribution of water by eliminating low spots where water accumulates. If the cuts are deep enough to expose the calcareous subsoil, the growth of crops is irregular or reduced for several years unless these areas are heavily manured or fertilized.

Capability Unit IIIs-14, Irrigated

This capability unit consists of well-drained soils on lake terraces, alluvial fans, and colluvial slopes. These soils are in the Bingham, Cleverly, Layton, Pleasant Grove, and Pleasant View series. The surface layer ranges from loam to fine sandy loam or gravelly fine sandy loam, and the underlying layers range from gravelly or very gravelly loam to loamy sand. These soils formed in alluvium or colluvium derived from sandstone, quartzite, and limestone. Slopes are 1 to 6 percent. Elevations range from 4,700 to 5,200 feet. The frost-free period is 150 to 170 days.

Permeability is rapid to moderately rapid. Runoff is slow to medium, and the hazard of erosion is slight to moderate. These soils hold 3.75 to 6 inches of available water to a depth of 5 feet. The very gravelly layers, below a depth of about 30 inches, restrict root penetration in some of the soils, otherwise roots penetrate to a depth of 5 feet.

The Layton soil has loamy fine sand texture below the surface layer and is not gravelly; in bare areas soil blowing is a moderate hazard in winter and in spring.

The soils in this unit are well suited to irrigated alfalfa, small grains, corn, and pasture, but corn generally is not grown on slopes of more than 3 percent. These soils are also suitable for peach, cherry, pear, and apple orchards. Some areas are in community development.

On those soils that have slopes of 3 percent or less, a suitable crop rotation consists of 4 years of alfalfa, 1 year of barley for grain; 1 or 2 years of corn for ensilage or grain; and 1 year of barley for grain with alfalfa seeded in the stubble. Pasture or alfalfa should be grown at least 25 percent of the rotation period.

Growing cover crops in orchards and plowing the sandy soils in spring protect the soils in winter and help to control wind erosion.

The efficient use of irrigation water is the principal concern of management. Land leveling should be restricted in the gravelly soils. Shallow cuts are possible in selected areas. The method of irrigation is generally governed by the crop to be grown. The sprinkler method is well suited to most crops; water can be applied at a rate of 0.3 to 0.7 inch per hour. Row crops and orchards are well suited to the furrow method. Where slopes are less than 3 percent and the soils are not too gravelly, the border method of irrigation is suitable for alfalfa and pasture.

These soils need about 3 inches of irrigation water every 7 to 10 days during the period of maximum water use. Orchards can be irrigated efficiently by using gradient furrows. If the furrow slope is 1.5 percent, 3 inches of water can be applied in about 3 hours by using a flow of 1 cubic foot per second for about 64 furrows 150 to 200 feet long. Three inches of water can also be applied efficiently to alfalfa or alfalfa and grass in 30 minutes by controlled flooding from gradient ditches 150 to 200 feet apart.

Nitrogen is the main fertilizer needed for orchards. It should be applied each year after the growing season starts, at the rate of 0.2 pound per inch of tree diameter. Phosphorus fertilizer should be applied at the rate of 25 to 45 pounds per acre every 2 to 3 years. Applications of potassium fertilizer may give better color to fruit, especially to apples.

Most crops on these soils respond well to applications of manure and commercial fertilizers. Nitrogen may be applied each year to pastures, corn, and small grains. Phosphorus should be applied when alfalfa is seeded and then every 2 years.

Capability Unit IIIs-26, Irrigated

This capability unit consists of moderately well drained soils on low lake terraces. These soils are in the Layton series. The surface layer is fine sandy loam and the underlying layers are loamy fine sand. These soils formed in sandy lake sediments derived from sandstone and quartzite. Slopes are 0 to 3 percent. Elevations are 4,485 to 4,700 feet. The frost-free period ranges from 130 to 150 days. The average annual precipitation is 14 to 16 inches.

Permeability is rapid, and runoff is slow. In bare areas soil blowing is a moderate hazard in winter and spring. These soils hold 3.75 to 6 inches of available water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet or to the water table. Depth to the water table is 36 to 60 inches.

These soils are used for community developments and for irrigated alfalfa, corn, tomatoes, pasture, and small grains. Most areas have been improved by drainage and leaching of the soluble salts.

A suitable crop rotation consists of 4 years of alfalfa or alfalfa for hay or pasture; 1 year of barley for grain; 1 year of sugar beets; 1 year of corn for silage; and 1 year of barley for grain with alfalfa seeded in the stubble.

Commercial fertilizers are usually needed in addition to manure and plant residue. Most crops respond to additions of nitrogen fertilizer, but legumes respond to applications of phosphorus.

Layton fine sandy loam, slowly permeable substratum, 0 to 1 percent slopes, holds 1 or 1.5 inches more of available water than the other soils in this unit. Its underlying material is silty clay loam or silty clay to a depth of 40 inches. These clayey layers influence the spacing and depth of tile drains.

These soils need about 2 inches of irrigation water every 6 or 7 days during periods of maximum water use. Where row crops are grown on slopes of about 1.5 percent, 2 inches of water can be applied efficiently in 1 1/2 hours by using a flow of 1 cubic foot per second for about 45 furrows 200 feet long. Shorter runs or more furrows are needed on steeper slopes.

These sandy soils are well suited to sprinkler irrigation. Water can be applied at a rate of 0.4 to 0.7 inch per hour.

Capability Unit IVe-UX, Nonirrigated

This capability unit consists of well-drained, gravelly and cobbly soils on lake terraces or alluvial fans. These soils are in the Bingham, Cleverly, Pleasant Grove, and Pleasant Vale series. The surface layer is gravelly or cobbly loam or sandy loam. The underlying material is gravelly or cobbly to very gravelly or very cobbly sandy clay loam to loamy sand. These soils formed in mixed lake sediments and alluvium derived from limestone, sandstone, quartzite, and granite. Slopes are 1 to 15

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percent. Elevations range from 4,700 to 5,200 feet. The frost-free period is 150 to 170 days. The average annual precipitation ranges from 14 to 20 inches.

Permeability is moderate to rapid. Runoff is slow to rapid, and the hazard of erosion is slight to severe. These soils hold 3.5 to 6 inches of available water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet, except in the very gravelly layers where root penetration is restricted.

These soils are used mainly for dryland alfalfa or wheat. Small areas have been seeded to grass for dryland pasture, and some areas of native grasses are pastured. The cobbly soils are better suited to permanent grass-legume hay or pasture than to crops.

To maintain the organic-matter content, good tilth, and water intake, the soils having slopes of 3 percent or less should be kept in grass-legume hay or pasture about 50 percent of the time. Where slopes are more than 3 percent, grass-legume hay or pasture should be grown about 75 percent of the time. Practices that leave large amounts of crop residue on the surface reduce runoff and help to control erosion. Stubble mulching helps to keep a protective cover on the surface.

Stripcropping across the steeper slopes is generally needed to slow runoff. Alternate strips of fallow-wheat and grass-legume are generally used.

Capability Unit IVw-24, Irrigated

This capability unit consists of moderately well drained to poorly drained soils on lake terraces, alluvial fans, and flood plains. These soils are in the Provo and Sunset series and the Preston variant. The surface layer is gravelly fine sandy loam to loamy fine sand. The underlying material ranges from very gravelly loamy sand to loam, fine sand, or loamy fine sand. The Sunset loamy fine sand is moderately saline-alkali, and is loam or very fine sandy loam below a depth of about 20 inches. The soils in this unit formed in mixed lake sediments and alluvium derived from sandstone, limestone, and quartzite. Slopes are 0 to 3 percent. Elevations range from 4,500 to 4,700 feet. The frost-free period is 130 to 150 days. The average annual precipitation ranges from 11 to 16 inches.

Permeability is moderate to rapid. Runoff is very slow or slow. Wind erosion is a slight to moderate hazard. These soils hold 2.5 to 6 inches of available water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet or to the water table.

These soils are used mainly for native pasture. Some areas have been drained and are used for irrigated small grains, alfalfa, and pasture, and some areas of the very gravelly soils are used for apple orchards.

A suitable crop rotation in drained areas is 4 years of alfalfa or grass and alfalfa for hay or pasture; 1 year of barley or oats for grain; and 1 year of small grain with alfalfa and grass seeded in the stubble. Pasture or grass should be grown at least 75 percent of the time.

Improved pasture usually requires additions of nitrogen fertilizer every year and phosphorus every 2 to 4 years. Phosphorus is usually applied when the alfalfa is seeded.

Drainage and controlling the water table are generally needed for good growth of adapted crops. Tile drains are commonly used; about 70 feet of tile per acre are placed 5 or 6 feet below the surface.

These soils are well suited to sprinkler irrigation. Water can be applied at a rate of 0.4 to 0.7 inch per hour. For surface irrigation, the length of runs and the interval between irrigations should be determined for each field because the water table fluctuates.

Capability Unit IVw-25, Irrigated

This capability unit consists of poorly drained and very poorly drained soils on low lake terraces. These soils are in the Chipman, Logan, and McBeth series. They formed in mixed lake sediments derived from limestone and shale. Their surface layer is silty clay loam. Slopes are 0 to 1 percent. Elevations are 4,490 to 4,600 feet. The frost-free period is 130 to 150 days. The average annual precipitation ranges from 12 to 16 inches.

Permeability is moderately slow to slow. Runoff is slow or very slow, and the erosion hazard is little or none. These soils hold 11 inches of available water to a depth of 5 feet. The water table fluctuates seasonally between depths of 0 and 60 inches. The Chipman soil has a moderately deep water table. It is at a slightly higher elevation than the other soils and is easier to drain.

These soils are used mainly for pasture of native grasses and for wildlife habitat. They are not well suited to cultivation at the present time, but they can be improved by drainage and reclamation. After drainage the soils are suited to improved pasture, and irrigated sugar beets, corn, or small grains. Truck crops can also be grown successfully.

Nitrogen fertilizer should be applied to grass pastures early in spring and in midsummer. Phosphorus should be applied every 2 to 4 years.

Drainage is generally difficult because of the low position and slow permeability of the soils. Drainage outlets are needed in some places. Land leveling after the soils are drained is very important for even distribution of irrigation water.

The length of runs and the interval between irrigations need to be determined on a field by field basis.

Capability Unit IVs-14, Irrigated

This capability unit consists of well-drained soils on lake terraces, alluvial fans, and colluvial slopes. These soils are in the Bingham, Cleverly,

Lakewin, Layton, Pleasant Grove, Preston, Steed, and Sterling series. The surface layer is mainly gravelly or cobbly loam, sandy loam, or fine sandy loam. The underlying material ranges from very gravelly or very cobbly loam to loamy sand. These soils formed in alluvium, colluvium, or lake-laid sediments derived from limestone, quartzite, sandstone, and shale. Slopes range from 1 to 25 percent, but they are dominantly 3 to 10 percent. Elevations are 4,600 to 5,700 feet. The frost-free period ranges from 130 to 170 days but is 150 to 170 days in most places. The average annual precipitation is 14 to 20 inches.

Permeability is rapid to moderately rapid. Runoff is very slow to rapid, and the hazard of erosion is slight to very severe. These soils hold 2.5 to 4 inches of available water to a depth of 5 feet. The very gravelly layers below a depth of about 30 inches restrict the penetration of roots in some of the soils, otherwise roots penetrate to a depth of 5 feet.

Steed sandy loam has a surface layer that is 8 to 20 inches thick over very gravelly loamy sand. This soil occurs where the frost-free period is only 130 to 150 days. Orchards generally are not grown on this soil, and yields or quality of some other crops are frequently reduced by frost. The Layton and Preston soils are loamy fine sand or fine sand throughout. On slopes of more than 6 percent, these soils are used mainly for range.

Most of the soils in this unit are used for irrigated peach, cherry, and apple orchards and for berry crops, but some areas are used for community development, range, irrigated pasture, alfalfa, or small grains. Some of these soils are an excellent source of sand and gravel.

A suitable crop rotation is 4 years of alfalfa or alfalfa and smooth bromegrass for hay; 1 year of barley for grain; and 1 year of barley for grain with alfalfa seeded in the barley stubble. The gravelly soils are easier to till when moist; the abrasive action of the gravel rapidly dulls and wears tillage tools.

Using irrigation water efficiently is a principal concern of management. Land leveling is usually not practical on slopes of more than 3 percent or on gravelly soils.

These soils are better suited to sprinkler irrigation than to other methods of irrigation because of their low water-holding capacity, high intake rate, or slope. Water can be applied at a rate of 0.4 to 0.7 inch per hour. Irrigation by gradient furrows is suitable for orchards on slopes of no more than 10 percent. Controlled flooding from gradient ditches is suitable for alfalfa and other close-growing crops and pasture.

These soils need about 3 inches of water every 7 to 9 days during periods of maximum water use. By using gradient furrows on slopes of 1.5 percent, orchards can be irrigated efficiently in 2 1/2 to 3 hours using a flow of 1 cubic foot of water per second for 50 furrows about 200 feet long.

Three inches of water also can be applied efficiently to alfalfa or alfalfa and grass by controlled flooding from gradient ditches spaced 75 to 120 feet apart.

Nitrogen is the main fertilizer needed for orchards. It should be applied each year at the start of the growing season and at a rate of 0.2 pound per inch of tree diameter. Phosphorus fertilizer should be applied at the rate of 25 to 45 pounds per acre every 2 or 3 years. Trial applications of potassium for fruit coloring, especially apples, is desirable. Legume crops need applications of phosphorus every 2 or 3 years.

Growing cover crops in orchards and leaving the crop residue on the surface protects the soils against erosion and helps to control weeds.

Capability Unit Vw-22, Nonirrigated

Provo Bay silty clay loam, the only soil in the capability unit, is a poorly drained, moderately saline-alkali soil on low lake terraces. It formed in mixed lake sediments derived from limestone, sandstone, and shale. Slopes are 0 to 1 percent. Elevations range from 4,485 to 4,500 feet. The frost-free period is 130 to 150 days. The average annual precipitation ranges from 12 to 14 inches. Depth to the water table ranges from 0 to 70 inches. Some areas are flooded frequently, others only occasionally, and some rarely.

Permeability is slow. Runoff is ponded to slow, and there is no erosion hazard. The soils hold about 12 inches of water to a depth of 5 feet, but the content of salt reduces the amount that is available to plants to about 9 inches.

This soil is used only for range. It produces only salt- or water-tolerant plants. If the range is in its best condition, the density of the plant cover is 80 to 90 percent and the plant cover consists mainly of grasses and a trace of forbs and shrubs. The most desirable plants are alkali bluegrass, alkali sacaton, creeping wildrye, alkali cordgrass, tufted hairgrass, and native clovers. They make up 50 to 60 percent of the plant cover. The less desirable plants are saltgrass, sedges, wiregrass, foxtail, Great Basin wildrye, western wheatgrass, rushes, cinquefoil, and greasewood, which comprise 35 to 45 percent of the vegetation. Tamarisk, poverty weed, annual Kochia, gumweed, plantain, pickelweed, and other undesirable plants make up about 5 to 10 percent of the vegetation.

Foxtail is a troublesome weed on wet sites and irrigated fields. The sharp pointed joints of these plants may be injurious to all grazing animals, especially to their nose, mouth, and eyes. These plants also contaminate the wool of sheep. Greasewood may be poisonous to animals if they eat large amounts at a time, especially if they are not used to grazing this plant.

The range is properly grazed if about 50 percent of the annual growth of desirable plants remains at the end of the season, the undesirable plants are not grazed, and the less desirable plants are only slightly grazed. The desirable plants are usually not ready for grazing until after April 15. Leaving

an abundant top growth helps to control erosion and to maintain good plant vigor.

Saltgrass and annual weeds are dominant where the native forage has been misused. Seeding tall wheatgrass or tall fescue in prepared seedbeds has been successful. These soils are better suited to grasses that tolerate occasional flooding than to other plants.

Utilizing and spreading waste irrigation water increases the amount and the quality of forage. Yields vary because flooding is frequent.

Capability Unit VIe-U, Nonirrigated

This capability unit consists of well-drained soils on lake terrace escarpments and rolling hills. These soils are in the Dry Creek, Hillfield, Taylorsville, and Welby series. Their surface layer is cobbly loam, silt loam, or silty clay loam, and the underlying material ranges from silt loam or silty clay loam to cobbly clay. These soils formed in mixed lake sediments and alluvium derived mainly from limestone, sandstone, and shale. Slopes are 6 to 30 percent. Elevations range from 4,700 to 5,700 feet. The frost-free period ranges from 130 to 170 days. The average annual precipitation is 14 to 18 inches.

Permeability is moderate to slow. Runoff is medium to rapid, and the hazard of erosion is moderate to very severe. These soils hold 5 to 11 inches of available water to a depth of 5 feet. The effective rooting depth is 5 feet or more.

These soils are well suited to the production of range forage. If the range is producing at its best, the density of the plant cover is 40 to 50 percent and the vegetation is about 60 percent perennial grasses and 20 percent each of forbs and shrubs. The most desirable plants make up 50 to 60 percent of the plant cover. They are oniongrass, bluebunch wheatgrass, Nevada bluegrass, slender wheatgrass, and Indian ricegrass. The desirable forbs and shrubs are hawksbeard, balsam roots, serviceberry, wild rose, and bitterbrush. Western wheatgrass, squirreltail, needle-and-thread, Great Basin wildrye, Sandberg bluegrass, cheatgrass, peavine, herbaceous sage, Indian paintbrush, wild onion, and yellowbrush are among the less desirable plants. They comprise 25 to 35 percent of the plant cover. The undesirable plants are mullein, gumweed, annual mustard, Russian-thistle, locoweed, deathcamas, big sagebrush, and rubber rabbitbrush. They comprise 15 to 20 percent of the plant cover.

Deathcamas is poisonous to cattle, sheep, and horses, even when dry. All parts of the plants are poisonous. Humans sometimes mistake the bulb of this plant for other plants and are poisoned by eating it. Some species of locoweed are poisonous to horses, sheep, and cattle. Some animals, especially horses, become addicted these plants and refuse to eat better feed.

If the range is properly used, about one-half of the annual growth of desirable plants remains at the end of the season. Leaving large amounts of plant litter and residue is important because they protect these highly erodible soils from damage by wind and water. Leaving about 50 percent of the top growth on the desirable species also helps the plants to maintain good vigor.

Restricting grazing to the proper season and duration is the main concern of management. The desirable native plants are generally not ready for grazing until May 1. About 1,800 pounds of total herbage per acre are produced in favorable years, and about 1,400 pounds in unfavorable years. In areas seeded to grasses, about 1,700 pounds of total herbage per acre are produced in favorable years and about 1,000 pounds in unfavorable years.

If the native vegetation is depleted, seeding grass in prepared beds provides additional forage and helps to control erosion. If big sagebrush has increased, but a fair understory of desirable grasses remains, chemical spraying or controlled burning is usually desirable. If correctly used, chemical sprays or burning do not kill the grass. After either treatment, it is especially important to defer grazing until the stand is established or the grass regains good vigor.

Capability Unit VIe-M, Irrigated

This capability unit consists of well-drained soils on mountain slopes. These soils are in the Henefer, McPhie, and Manila series. The surface layer is loam, silt loam, or sandy loam, and the subsoil ranges from cobbly loam to cobbly clay. Some of the soils have stones or cobblestones on the surface. These soils formed in alluvium or colluvium derived from mixed sedimentary rocks and intermediate igneous rocks. Slopes are 5 to 30 percent. Elevations range from 5,135 to 7,000 feet. The frost-free period is 80 to 100 days. The average annual precipitation ranges from 18 to 25 inches.

Permeability is moderate to slow. Runoff is slow to medium, and the hazard of erosion is moderate. These soils hold 6 to 11 inches of available water to a depth of 5 feet. The effective rooting depth is 5 feet or more.

These soils are well suited to the production of range forage. If the range is producing at its best, the density of the plant cover is 50 to 60 percent and the vegetation is about 60 percent grasses and 20 percent each of forbs and shrubs. The most desirable forage plants are oniongrass, tall native bluegrass, mountain bromegrass, Columbia needlegrass, hawksbeard, balsamroot, bitterbrush, and serviceberry. These species make up about 50 percent of the plant cover. The less desirable plants include Letterman needlegrass, dryland sedge, Kentucky bluegrass, Great Basin wildrye, squirreltail, needle-and-thread, Indian paintbrush, chokecherry, and snowberry. They comprise about 25 percent of the plant cover. The undesirable plants are cheatgrass, houndstongue, mullein, deathcamas, locoweed, gumweed, big sagebrush, oakbrush, and spineless horsebrush. They make up 20 to 30 percent of the plant cover.

Deathcamas is poisonous to cattle, sheep, and horses, even when dry. All parts of this plant are poisonous. Humans sometimes mistake the bulb for other plants and are poisoned if they eat it. Some species of locoweed are poisonous to horses, sheep, and cattle. Some animals, particularly horses, become addicted to this plant and will not eat better feed. Spineless horsebrush is grazed occasionally by sheep, and they get the "big head." This shrub sensitizes white-haired animals and often causes severe dermatitis. If other shrubs are scarce, oakbrush is considered good forage for livestock, particularly deer, but sheep become sick and cattle often die if their diet consists only of this shrub.

If the range is properly grazed, about half of the annual growth of desirable plants remains at the end of the season which helps the plants to maintain good vigor; the undesirable plants are not grazed, or are only slightly grazed. Abundant plant litter and residue left on the surface protects the soil against erosion.

Oakbrush is the dominant plant in some places. Controlled burning, followed immediately by grass seeding, and then spraying the suckers has been partly successful in eradicating oakbrush. This method is expensive and areas to be sprayed should be accessible to spray equipment.

In areas where the native vegetation is depleted, grass can be seeded in prepared seedbeds to provide additional forage and to help control erosion.

If big sagebrush has increased, but a fair understory of desirable grasses remains, chemical spraying or controlled burning generally is feasible. If correctly used, chemical sprays or burning do not kill the grass. Delaying grazing for about 2 years after treatment is necessary for the grasses to regain good vigor.

The desirable plants are generally not ready for grazing until June 1. About 2,750 pounds of total herbage per acre are produced in favorable years, and about 1,500 pounds are produced in unfavorable years. If seeded to grasses, the soils in this unit will produce about 2,500 pounds of total herbage per acre in favorable years and 1,200 pounds in unfavorable years.

Capability Unit VIw-25, Nonirrigated

This capability unit consists only of Mixed alluvial land. The texture and the depth to water table vary widely. This land occurs near stream channels, especially in areas where streams enter Utah Lake. Some large areas are along the Jordan River and in Provo Bay. Slopes are 0 to 1 percent. Elevations are 4,485 to 4,600 feet. The frost-free season ranges from 130 to 150 days. The average annual precipitation is 12 to 14 inches.

This land is suitable for the production of grass for forage. If it is producing at its best, the density of the plant cover is 85 to 100 percent. The vegetation consists mainly of water-tolerant grasses and grasslike plants. The most desirable plants are meadow barley, redtop, slender wheatgrass, nodding bromegrass, timothy, native bluegrasses, tufted hairgrass, native clover, and White Dutch clover. They make up 55 to 65 percent of the plant cover. The undesirable plants, such as teasel, rubber rabbitbrush, poverty weed, gumweed, bullthistle, plantain, and aster, comprise about 35 percent of the plant cover.

Some areas are used more for wildlife habitat than for grazing. Some of the grasses are mowed and used for wild hay. Livestock graze the drier sites, but the wetter areas can be grazed only when the soil is frozen.

This land is generally too wet for the preparation of seedbeds. Seeding should be considered only if the native vegetation is very depleted.

The range is properly grazed if about 40 percent of the current annual growth of desirable plants remains at the end of the grazing season.

The desirable plants are usually not ready for grazing until May 5 to 20. About 2,500 pounds of total herbage per acre are produced in favorable years, and about 1,500 pounds per acre in unfavorable years.

Capability Unit VIs-U4, Nonirrigated

This capability unit consists of well-drained to excessively drained, stony, gravelly, or cobbly soils on mountain slopes, terrace escarpments, and alluvial fans. These soils are in the Kilburn, Lakewin, Pleasant Grove, Steed, and Sterling series. Their surface layer is stony loam, stony sandy loam, or gravelly and cobbly fine sandy loam. The texture of the underlying layers is similar to that of the surface layer, but these layers are very gravelly, cobbly, or stony. These soils formed in alluvium derived from limestone, quartzite, sandstone, and granite. Slopes are 3 to 35 percent. Elevations range from 4,560 to 5,700 feet. The frost-free period is 150 to 170 days. The average annual precipitation ranges from 14 to 19 inches.

Permeability is moderately rapid to rapid. Runoff is slow to medium, and the hazard of erosion is slight to very severe The soil holds 3.5 to 6 inches of available water to a depth of 5 feet. Roots generally penetrate to a depth of 5 feet or more, but they are restricted in places by gravel or cobblestones.

The soils in this unit are better suited to the production of range forage than to other uses. If the range is producing at its best, the density of the plant cover is 30 to 40 percent and the vegetation is mainly perennial grasses. The most desirable plants comprise 45 to 55 percent of the plant cover, and they are mainly tall native bluegrass, bluebunch wheatgrass, bearded wheatgrass, oniongrass, Indian ricegrass, and prairie junegrass. The forbs and shrubs are hawksbeard, balsamroot, bitterbrush, serviceberry, and birchleaf mountain-mahogony.

The less desirable plants are needle-and-thread, Letterman's needlegrass, Sandberg bluegrass, squirreltail, Great Basin wildrye, dryland sedge, herbaceous sage, peavine, yarrow, buckwheat, Indian

paintbrush, yellowbrush, and snowberry. These grasses and forbs and a few shrubs comprise 30 to 40 percent of the plant cover.

The undesirable plants, such as three-awn, cheatgrass, Russian-thistle, annual mustard, annual sunflower, gumweed, mullein, big sagebrush, and snakeweed, make up 15 to 20 percent of the plant cover.

Snakeweed is grazed by sheep, cattle, and horses if it is the dominant plant on the range. It has caused animals to become sick or even die if heavily grazed.

The desirable plants are properly grazed if about half of their annual growth remains at the end of the season.

Large amounts of plant litter and residue should be left on the soil for protection against wind or water erosion. The remaining forage also helps the plants to maintain good vigor. The desirable plants are usually not ready for grazing until May 1 to May 15. About 1,850 pounds of total herbage per acre are produced in favorable years, and about 1,300 pounds in unfavorable years. If seeded to grasses, about 1,500 pounds of total herbage per acre are produced in favorable years and 1,200 pounds in unfavorable years.

If the native vegetation is depleted, grass can be planted in prepared seedbeds to provide additional forage and to control erosion. Stones and cobblestones interfere with the preparation of the seedbed in some places.

Chemical spraying or controlled burning are feasible in some areas where big sagebrush has increased but a fair understory of desirable plants remains. Chemical sprays or burning will not kill the grass if they are used correctly. If these areas are not used for 2 years after treatment the grasses regain their good vigor.

Capability Unit VIIe-U, Nonirrigated

This capability unit consists of well-drained soils on hillsides and lake terrace escarpments. These soils are in the Dry Creek, Hillfield, and Layton series. They have a surface layer of cobbly loam, silt loam, or loamy fine sand. The underlying layers are cobbly clay to loamy fine sand. These soils formed in mixed lake sediments and alluvium derived from sandstone, limestone, and shale. Slopes are 30 to 70 percent. Elevations range from 4,700 to 6,000 feet. The frost-free period ranges from 130 to 170 days. The average annual precipitation is 12 to 18 inches.

Permeability is slow to rapid. Runoff is medium to rapid, and the hazard of erosion is severe or very severe. These soils hold 4 to 11 inches of available water to a depth of 5 feet. The effective rooting depth is 5 feet or more.

These soils are well suited to the production of range forage. If the range is producing at its best, the density of the plant cover is 40 to 50 percent and the vegetation is about 60 percent perennial grasses and 20 percent each of forbs and shrubs. The most desirable plants comprise 50 to 60 percent of the plant cover. They are oniongrass, bluebunch wheatgrass, Nevada bluegrass, slender wheatgrass, Indian ricegrass, hawksbeard, balsamroot, serviceberry, wild rose, and bitterbrush. The less desirable plants, such as western wheatgrass, squirreltail, needle-and-thread, Great Basin wildrye, Sandberg bluegrass, cheatgrass, peavine, herbaceous sage, Indian paintbrush, wild onion, and yellowbrush, comprise 25 to 35 percent of the plant cover. The undesirable plants are mullein, gumweed, annual mustard, Russian-thistle, locoweed, deathcamas, big sagebrush, and rubber rabbitbrush. They make up 15 to 20 percent of the plant cover.

Some species of locoweed are poisonous to horses, sheep, and cattle. Some animals, particularly horses, become addicted to this plant and will not eat better feed. Deathcamas is poisonous to cattle, sheep, and horses, even when dry. All parts of this plant are poisonous. Humans sometimes mistake the bulb for other plants and are poisoned if they eat it.

If the range is properly grazed, about half of the current growth of desirable plants remains at the end of the season. Abundant plant litter and residue are needed to protect these highly erodible soils from wind and water erosion; the forage left enables the plants to maintain good vigor.

The main concern of management is restricting grazing to the proper time and duration. The desirable native plants are generally not ready for grazing until May 1. About 1,800 pounds of total herbage per acre are produced in favorable years and about 1,400 pounds in unfavorable years.

Capability Unit VIIe-M, Nonirrigated

This capability unit consists of well-drained, very steep, cobbly soils on hillsides. These soils are in the Gappmayer, Henefer, McPhie, and Picayune series. They have a surface layer of loam, cobbly loam, cobbly sandy loam, or cobbly silt loam. Their subsoil ranges from cobbly loam to cobbly clay. These soils formed in alluvium or colluvium derived from mixed sedimentary rocks, mainly limestone and sandstone. Slopes are 30 to 70 percent. Elevations range from 5,500 to 7,500 feet. The frost-free period is 80 to 100 days. The average annual precipitation ranges from 18 to 25 inches.

Permeability is dominantly moderate to slow. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. Most of these soils hold 5 to 8 inches of available water to a depth of 5 feet. The effective rooting depth is 5 feet or more.

The Gappmayer soil has a surface layer of cobbly loam and very gravelly or cobbly subsoil material. It holds about 3 inches of available water to a depth of 5 feet. Permeability is rapid.

The soils in this unit are fairly well suited to the production of range forage. If the range is at its best, the density of the plant cover is 45 to 55 percent and about 50 percent is grass and 50 percent is shrubs and forbs.

The most desirable plants make up 45 to 55 percent of the plant cover. They are oniongrass, slender wheatgrass, mountain bromegrass, Nevada bluegrass, bearded wheatgrass, bluebunch wheatgrass, balsamroot, bitterbrush, service berry, and birchleaf mountain-mahogony.

The less desirable plants, such as Letterman's needlegrass, dryland sedge, Kentucky bluegrass, Great Basin wildrye, squirreltail, Indian ricegrass, Sandberg bluegrass, herbaceous sage, Indian paintbrush, little sunflower, peavine, wild onion, snowberry, and chokecherry, make up 25 to 35 percent of the plant cover.

The undesirable plants include cheatgrass, bullthistle, gumweed, houndstongue, deathcamas, mullein, rubber rabbitbrush, big sagebrush, oakbrush, and spineless horsebrush. They make up 15 to 25 percent of the vegetation.

Chokecherry is moderately grazed by cattle and sheep, even though it is bitter. It may be poisonous if grazed after a frost. If other shrubs are scarce, oakbrush is considered good forage for livestock, particularly deer, but sheep become sick and cattle often die if their diet consists only of this shrub. Deathcamas is poisonous to cattle, sheep, and horses, even when dry. All parts of this plant are poisonous. Humans sometimes mistake the bulb for other plants and are poisoned if they eat it. Spineless horsebrush is grazed occasionally by sheep, and they get the "big head." This shrub sensitizes white-haired animals and often causes severe dermatitis.

On slopes of less than 40 percent the range is properly grazed if about half of the annual growth of desirable plants remains at the end of the season. On slopes of more than 40 percent the amount of top growth that remains should be increased 15 percent for each 10 percent increase in slope; on slopes of 50 percent, only 35 percent of the annual growth of plants should be grazed; slopes of 70 percent or more are too steep for grazing.

Because of steepness, the soils in this unit are not suitable for seeding grass in prepared beds. Aerial spraying or controlled burning of big sagebrush are desirable in some areas that have a fair understory of the better grasses. Chemical spraying and controlled burning do not kill the grass if managed correctly. The treated areas should not be grazed for at least 2 years if the grass is to regain good vigor.

The desirable plants generally are not ready for grazing until June 1 to June 10. About 2,750 pounds of total herbage per acre are produced in favorable years and about 1,500 pounds in unfavorable years.

Capability Unit VIIw-22, Nonirrigated

This capability unit consists of soils in the Peteetneet and Holdaway complex. The peat ranges from 30 to more than 60 inches in thickness. It is underlain by mineral soil material. The soils in this unit occur on low lake terraces that are less than 25 feet above the present level of Utah Lake. Natural drainage is very poor, and the water table is at or near the surface most of the time.

The soils in this unit produce mainly water-tolerant grasses and grasslike plants. If they are producing at their best, the density of the plant cover is 80 to 100 percent. The vegetation is mainly grasses, and the most desirable plants are redtop, tufted hairgrass, creeping wildrye, and native clover. They make up 20 to 30 percent of the plant cover. The less desirable plants comprise 50 to 60 percent of the vegetation. They are rushes, sedges, wiregrass, cinquefoil, saltgrass, and foxtail. The undesirable plants, which make up 10 to 15 percent of the vegetation, are bullthistle, cocklebur, teasel, cattail, arrowgrass, and common reed.

Foxtail is a troublesome weed on wet sites and irrigated fields. The sharp pointed joints of this plant may be injurious to all grazing animals, particularly to their nose, mouth, and eyes. They also contaminate the wool of sheep. Arrowgrass is poisonous to some livestock.

The soils in this unit are used more for wildlife habitat than for grazing, and in some areas the grass is cut for wild hay. About 4,500 pounds of total herbage per acre are produced in favorable years, and 3,000 pounds in unfavorable years.

The drier areas are often overgrazed by livestock, but the wetter areas can be grazed only if frozen. These soils are generally too wet for preparing seedbeds.

Capability Unit VIIw-285, Nonirrigated

This capability unit consists of poorly drained to moderately well drained, saline-alkali soils on alluvial fans and low lake terraces. These soils are in the Arave, Benjamin, Chipman, Holdaway, Jordan, Kirkham, and Payson series. Their surface layer is silt loam to silty clay, and the underlying layers range from silty clay loam to clay. These soils formed in mixed lake sediments and in alluvium derived from limestone, sandstone, and shale. Slopes are 0 to 1 percent. Elevations range from 4,490 to 4,600 feet. The frost-free period is 130 to 150 days. The average annual precipitation ranges from 10 to 17 inches.

Permeability is very slow to moderately slow. Runoff is very slow to slow, and the hazard of erosion is none to moderate. The soil holds 8 to 11 inches of water to a depth of 5 feet, but the salt content reduces the amount of water available to plants to 2 to 4 inches. Roots penetrate to a depth of 5 feet, but in many places the effective rooting depth is limited by layers of strongly saline-alkali material.

The soils in this unit are suited only to the production of salt- or alkali-tolerant forage plants. If the range is at its best, the density of the plant cover is 45 to 55 percent. The potential plant cover is about 80 percent salt- and alkali-tolerant grasses and 20 percent alkali-tolerant

shrubs. The most desirable plants make up 50 to 60 percent of the vegetation. They are alkali bluegrass, alkali cordgrass, alkali sacaton, tufted hairgrass, creeping wildrye, four-wing saltbrush, and Nuttall saltbush. The less desirable plants, saltgrass, cheatgrass, foxtail, squirreltail, gray molly, and greasewood, make up 35 to 45 percent of the plant cover. The undesirable plants make up 5 to 10 percent of the vegetation. They consist mainly of snakeweed, poverty weed, and pickleweed. Other annual weeds are also present in minor quantities.

Greasewood may be poisonous to animals if they eat large amounts at a time, particularly if they generally do not graze this plant.

The desirable plants are properly grazed if half or slightly less than half of the annual growth remains at the end of the season. The undesirable plants generally are not grazed.

Leaving an abundant top growth is important if good plant vigor is maintained. In many areas the desirable plants are so depleted that greasewood has become dominant, but if this plant is removed, the desirable plants increase in vigor and the quality of the forage improves. Where water is available for irrigation, some areas have been cleared and seeded successfully to tall wheatgrass; these areas are seeded by broadcasting the seed without disturbing the surface soil. Seeding is not feasible if irrigation water is not available. Tilling disperses the soils and makes them impervious to water. Seeding with as little disturbance to the soil as possible helps to keep the soil mellow and friable, and it provides for better seedling survival. Deferring grazing for two seasons after planting helps the seedlings to become established.

The soils in this unit are particularly susceptible to compaction or puddling if they are trampled by livestock when wet. If the soil is compacted, infiltration of water becomes very slow and the emergence and growth of seedlings are slowed.

The desirable plants usually are not ready for grazing until April 15. About 2,500 pounds of total herbage per acre are produced in favorable years and about 1,000 pounds in unfavorable years.

Capability Unit VIIs-UX4, Nonirrigated

This capability unit consists of well-drained to excessively drained, stony and cobbly soils and Cobbly alluvial land on alluvial fans, hillsides, and terrace escarpments. These soils are in the Dry Creek, Kilburn, Sterling, and Pleasant Grove series. They have a surface layer of stony loam, stony sandy loam, or gravelly or cobbly sandy loam. The underlying material ranges from very gravelly or very cobbly sandy loam to very stony clay. These soils formed in alluvium or colluvium derived from limestone, sandstone, quartzite, or granite. Slopes are 1 to 70 percent. Elevations range from 4,600 to 5,700 feet. The frost-free period is 130 to 170 days. The average annual precipitation ranges from 14 to 19 inches.

Permeability is moderate to rapid. Runoff is medium, and the hazard of erosion is moderate to severe. These soils hold 3.5 to 5 inches of available water to a depth of 5 feet. The effective rooting depth is 5 feet or more.

The soils in this unit are well suited to the production of range forage. If the range is producing at its best, the density of the plant cover is 35 to 45 percent, and the vegetation is about 50 percent grass and 25 percent each of forbs and shrubs. The most desirable plants are bluebunch wheatgrass, prairie junegrass, big bluegrass, Indian ricegrass, Nevada bluegrass, muttongrass, hawksbeard, balsamroot, serviceberry, bitterbrush, and birchleaf mountain-mahogony. These species make up 40 to 50 percent of the plant cover. The less desirable plants include needle-and-thread, Sandberg bluegrass, squirreltail, Great Basin wildrye, dryland sedge, herbaceous sage, wild onion, Indian paintbrush, blue elderberry, yellowbrush, and snowberry. They make up 35 to 45 percent of the vegetation. The undesirable plants, such as cheatgrass, mullein, locoweed, foxglove, Russian-thistle, oakbrush, and big sagebrush, comprise 10 to 20 percent of the vegetation.

Some species of locoweed are poisonous to horses, sheep, and cattle. Some animals, particularly horses, become addicted to this plant and will not eat better feed. If other shrubs are scarce, oakbrush is considered good forage for livestock, particularly for deer, but sheep become sick and cattle often die if their diet consists only of this shrub.

On slopes of 30 to 40 percent one-half of the annual growth of the desirable plants can be grazed. On slopes of more than 40 percent the amount of top growth that should be left is increased 15 percent for each 10 percent increase in slope. Thus, on slopes of 50 percent only 35 percent of the annual growth should be grazed. The soils that have slopes of more than 70 percent are too steep for grazing. The less desirable plants show only slight to moderate use at the end of the grazing season.

Seeding in a prepared seedbed is not feasible on the very steep, stony soils. Chemical spraying and controlled burning are feasible in some areas where big sagebrush has increased but where there is a fair understory of the better grasses. Chemical sprays or burning do not kill the grass if correctly used. The treated areas need a 2-year rest period to allow the grasses to regain vigor.

The desirable plants usually are not ready for grazing until May 5 to May 20. The yield of total herbage is about 1,850 pounds per acre in favorable years and about 1,300 pounds per acre in unfavorable years.

Capability Unit VIIs-UX3, Nonirrigated

This capability unit consists of well-drained soils on hillsides, mainly on slopes that face west. These soils are in the Rake series. They formed in alluvium or colluvium derived from limestone and have

an indurated hardpan of lime above a depth of 20 inches. The subsoil is very cobbly clay loam. Elevations range from 5,100 to 6,500 feet. The frost-free period is 130 to 150 days. The average annual precipitation ranges from 15 to 18 inches.

Permeability is moderate above the hardpan, but it is very slow in the hardpan. Runoff is medium to rapid, and the hazard of erosion is moderate to severe.

This soil is fairly well suited to the production of range forage. If the range is producing at its best, the density of the plant cover is 25 to 30 percent and the vegetation is mainly perennial grasses. The most desirable plants comprise 45 to 55 percent of the vegetative cover and are mainly grasses. They are bluebunch wheatgrass, tall native blue grasses, Indian ricegrass, prairie junegrass, hawksbeard, balsamroot, bitterbrush, birchleaf mountain-mahogony, and serviceberry. About one-half of the less desirable plants is grasses and the rest is forbs and shrubs. These plants are needle-and-thread, Letterman's needlegrass, squirreltail, Sandberg bluegrass, sand dropseed, cheatgrass, dryland sedge, herbaceous sage, wild onion, big sagebrush, yellowbrush, and cliffrose. They make up 35 to 45 percent of the plant cover.

The undesirable plants comprise 10 to 15 percent of the plant cover. They are locoweed, deathcamas, annual mustard, gumweed, mullein, narrow leaf mountain-mahogony, and rubber rabbitbrush.

Some species of locoweed are poisonous to horses, sheep, and cattle. Some animals, particularly horses, become addicted to this plant and will not eat better feed. Deathcamas is poisonous to cattle, sheep, and horses, even when dry. All parts of this plant are poisonous. Humans sometimes mistake the bulb for other plants and are poisoned if they eat it.

On slopes of less than 40 percent the range is properly grazed if about one-half of the annual growth of desirable plants remains at the end of the season. On slopes of more than 40 percent the amount of top growth that should be left is increased 15 percent for each 10 percent increase in slope. Slopes of 70 percent or more are too steep to be grazed.

Because of the slope and the stony surface layer, the preparation of a seedbed is impossible on these soils. Spraying or controlled burning of big sagebrush is desirable in areas that have a fair understory of the better grasses. Chemical spraying or controlled burning do not kill the grass if correctly used. Treated areas should not be used for at least 2 years to allow the grass to regain good vigor.

The desirable plants generally are not ready for grazing until May 1. About 1,700 pounds of total herbage per acre are produced in favorable years, and about 1,200 pounds in unfavorable years.

Capability Unit VIIIw-2, Nonirrigated

This capability unit consists of areas of Beaches and of soils in the Provo Bay series that are inundated or flooded most of the time. Beaches occur along the shores of Utah Lake. A few areas produce useful vegetation in some years. Because these areas are typically near water, their value as wildlife habitat can be maintained or increased by good management.

Capability Unit VIIIw-4, Nonirrigated

This capability unit consists of the land type Riverwash, which is adjacent to the river or stream channels. This land includes sand bars, meander bars, or other land features that formed by shifting stream patterns or by flooding. The vegetation consists of annual weeds, willow, and wiregrass. Some areas are bare. This land provides habitat for wildlife.

Capability Unit VIIIw-8, Nonirrigated

This capability unit consists of Mixed alluvial land, saline, and of Terrace escarpments. Mixed alluvial land ranges from sand to clay in texture and has a crust of salt on the surface (pl. I, top). Most areas are bare. The water table fluctuates considerably, but it is usually at a depth of 36 inches or more. A sparse cover of pickleweed and samphire occurs in some places. Because of the high salt content of the soil material, this capability unit has no known farm use. Reclaiming these areas for cultivated crops or improved pasture is not economically feasible.

Capability Unit VIIIs-4, Nonirrigated

This capability unit consists of areas of Pits and Dumps and Terrace escarpments. These areas are dumps, gravel pits, borrow pits for roads, and excavations for canals or buildings, and areas of very steep, raw soil material. They are not suited to the commercial production of plants.

These areas can be used as a source of material for highway or other construction. They can be managed for wildlife habitat.

Capability Unit VIIIs-X, Nonirrigated

This capability unit consists only of Rock land, a miscellaneous land type that includes all areas of rock outcrops, cliffs, and talus slopes, and areas where a thin layer of soil material is over bedrock. This land can be used as a source of material for highway or other construction. It can also

be used for esthetic purposes, as habitat for wildlife, and for watershed purposes.

Estimated Yields

Table 1 gives the estimated average acre yields of the principal crops, pasture plants, and fruit trees grown mainly on irrigated soils under two levels of management. They are averages for a period of years. In any given year, yields may be higher or lower than the average. These yields are estimated on the basis of information and records obtained from farmers, and on field observations of soil conservationists. The collected information was reviewed by the local County Agricultural Agent. If no information was available for a particular soil, the estimates were made on the basis of yields on a similar soil. Only soils that are suitable for the crops, pasture plants, and fruit trees specified are listed in table 1.

Under both levels of management, yields are based on a generalized cropping sequence consisting of legumes, small grains, row crops, and alfalfa. This cropping sequence or a variation of it is used in most of the survey area. A small grain crop is grown as a companion crop to new seedings of alfalfa.

In table 1 the yields in columns A are those obtained under average, or common, management. Under common management, phosphorus fertilizer is applied sparingly or not at all; nitrogen is seldom used or is used in insufficient quantities. Most of the available animal manure is spread, but it is not properly stored or incorporated into the soil. Sugar beets generally are fertilized with phosphorus and nitrogen. Crop rotation plans are not followed. Alfalfa is sometimes grown for 6 to 10 years and becomes weedy. Small grains and row crops are grown for 4 to 6 years. Spring plowing and disking several times to prepare a seedbed is the common practice. Water-control structures generally are inadequate; water is applied without enough regard to proper length of runs and to the needs of the crop grown. Pastures are not clipped, rotation grazing is not practiced, little or no commercial fertilizer is applied, and animal droppings generally are not scattered.

The yields in columns B are those expected under a moderately high level of management. This management provides that phosphorus fertilizer is applied when alfalfa is seeded and again after 2 or 3 years. Nitrogen fertilizer is used on row crops and on small grains after the first year out of alfalfa, unless adequate animal manure is applied. Animal manure is properly stored and is spread and incorporated into the soil within a short time. Tillage is reduced to essential and timely operations to avoid traffic pans or compacting the soil. In addition, control structures are used for handling irrigation water; length of runs are adapted to soil conditions; water is applied according to the crop requirements; crop rotations generally are consistent; and weeds are controlled.

A moderately high level of management for pasture includes rotation grazing; allowing the necessary regrowth period; clipping to control weeds; spreading droppings; applying nitrogen fertilizer once or twice a year; and applying phosphorus fertilizer every 2 or 3 years. The pasture is grazed every 28 or 40 days. It is not grazed when the soil is wet enough to pack or in the spring until the plants are 8 to 10 inches high; at least 4 inches of plant growth is left in the fall.

Cool air tends to settle in the lower parts of the valleys in mountainous areas. Because warm air rises during the day and air drains from the canyons at night, areas at the higher elevations have a longer frost-free period than other parts of the survey area.

The longer frost-free period, at elevations of more than 4,700 feet, allows farmers to have a greater variety of crops and higher yields than are feasible in other parts of the survey area. For this reason, the soils in these areas are designated "extended season" phases to separate them from their counterparts at elevations of less than 4,700 feet. Most of the orchards are in these areas.

The frost-free period in areas at elevations of more than 4,700 feet is 150 to 170 days, and the mean annual air temperature is 51° to 52° F. The frost-free period at elevations of less than 4,700 feet is between 130 and 150 days, and the mean annual air temperature is 49° or 50° F.

The amount of soluble salts or alkali in the soil determines the kinds of crops that can be grown and affects crop yields. Some of the soils in this survey area contain excessive soluble salts, alkali, or both. In some places, the concentration of salt and alkali is moderate to strong.

Use of Soils For Wildlife

All kinds of wildlife require suitable habitat that provides enough food, water, and living space to support their daily activity. If the landowner insures that these elements of wildlife habitat are plentiful, the wildlife population in an area will increase.

The kinds of wildlife that live in a given area and the number of each kind are closely related to land use and the resulting kinds and patterns of vegetation. These, in turn, are generally related to the kinds of soils. The uses of the soils for farming are correlated with their suitability for wildlife. Nonirrigated land in farms may provide living space and cover but little food or water; irrigated land provides the food and water, especially during summer and fall.

The soils in this survey area have been grouped in three wildlife suitability groups, each containing two or more soil associations. The soil associations have been grouped because they are similar in land use, or plant cover, or both. The soil associations are shown on the colored map at the back of this survey and are described in the section "General Soil Map." The three wildlife suitability groups are described on page 25.

Wildlife Suitability Group 1

This wildlife group is made up of the soils in the Chipman-McBeth, the Payson-Logan, Heavy Variant-Arave, the Taylorsville-Welby, the Pleasant Vale-Kirkham-Sunset, the Steed-Pleasant Vale-Redola, and the Benjamin-Kirkham soil associations. These associations are on lowlands surrounding Utah Lake and are on the flood plains in the valley. They are generally less than 100 feet above the present level of Utah Lake, and they include irrigated farmland, wet marshes, flood plains, and lake shores.

The kinds of wildlife adapted to these associations and the indigenous environment include ringneck pheasants, mourning doves, ducks, geese, quail, and cottontail rabbits. Muskrats and a few beaver are confined to the marshlands, stream channels, and irrigation canals. A few deer live in these associations during periods of deep snow in the mountains.

Starlings, crows, ravens, and sparrows are often regarded as noxious birds in this survey area because they damage livestock feeding operations, orchards, and standing field crops. Pheasants are sometimes included in this group by some land users because they damage domestic crops and seedings.

Mice and rats are very destructive to orchards, standing vegetation, and stored crops. They often create serious economic problems on and off the farm. Weasels, skunks, coyotes, and hawks prey on these animals as a source of food.

Beavers, mink, and fox are raised commercially for their fur. Muskrats are trapped from drainage ditches, streams, and irrigation canals as a source of income and to lessen farm problems.

Wildlife Suitability Group 2

This wildlife group is made up of the soils in the Bingham-Parleys, the Pleasant Grove-Cleverly-Kilburn, the Lakewin-Layton, and the Welby-Hillfield soil associations. These associations consist of well-drained soils on high lake terraces, alluvial fans, and colluvial slopes. They occur at elevations of 4,700 to 5,600 feet.

The kinds of wildlife in these soil associations include chukar partridge, Hungarian partridge, quail, cottontail rabbit, and deer. Pheasant inhabit areas at the higher elevations during the hunting season, but they leave these areas when the hunting season is over. The colluvial slopes are preferred by the chukar partridge. A few deer winter on the south and west slopes. Bullsnakes, rattlesnakes, and watersnakes live in areas of this wildlife group.

Wildlife Suitability Group 3

This wildlife group is made up of the soils in the Henefer-Manila-Dry Creek and Rake-Picayune soil associations. These associations occupy foothills and steep mountain slopes above the valleys. They are at elevations of 5,200 to 7,000 feet.

Deer, coyote, bobcat, a few bear, cottontail rabbit, hare, chukar partridge and, in some places, rattlesnakes inhabit these soil associations.

Engineering Applications[2/]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion-control structures, drainage systems, irrigation systems, and sewage disposal systems. Among the properties most important in engineering are internal friction, cohesion, permeability to water, compressibility, drainage, volume-change characteristics, particle size distribution, plastic limit, liquid limit, and reaction. Also important are topography, depth to the water table, and depth to bedrock.

Information concerning these and related soil properties is furnished in tables 2, 3, and 4. In these tables are estimates, interpretations, and test data that can be used to--

1. Make studies of soil and land use that will aid in selecting and developing sites for industry, businesses, residences, summer homes, and recreation.
2. Make reconnaissance estimates of the engineering properties of soils for use in designing agricultural drainage systems, farm ponds, irrigation systems, and erosion-control structures.
3. Locate probable sources of sand, gravel, clay, and other construction material.
4. Make reconnaissance surveys of soil and site conditions that will help in selecting locations for highways, airports, and pipelines, and in planning detailed soil investigations for the intended locations.
5. Develop other preliminary estimates for construction purposes pertinent to a particular area.
6. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps and reports and from aerial photographs for making specific maps and reports that can be used readily by engineers.

With the use of the soil map for indentification, the engineering interpretations reported here can be useful for many purposes. It should be emphasized, however, that they do not eliminate the need for

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2/ GILBERT P. SEARLE, agricultural engineer, Soil Conservation Service, assisted in the preparation of this section.

TABLE 1.--ESTIMATED AVERAGE ACRE YIELDS OF PRINCIPAL

[Yields in columns A are to be expected under common management; yields in columns B are to be expected under

Soil	Alfalfa		Corn (silage)		Sweet corn		Barley	
	A	B	A	B	A	B	A	B
	Tons	Tons	Tons	Tons	Tons	Tons	Bu.	Bu.
Benjamin silty clay	4	6	15	20	4	5	60	100
Benjamin silty clay, moderately alkali	1½	2	---	---	---	---	30	45
Benjamin silty clay, strongly alkali 1/	---	---	---	---	---	---	---	---
Benjamin silty clay, sandy substratum	4	6	15	20	4	5	60	100
Bingham loam, 1 to 3 percent slopes	3	5	10	15	3	4	50	80
Bingham gravelly loam, 1 to 3 percent slopes	3	4½	10	15	3	4	50	70
Bingham cobbly loam, 3 to 6 percent slopes	2	3	---	---	---	---	---	---
Bingham cobbly loam, 3 to 6 percent slopes 2/	1	1¼	---	---	---	---	---	---
Bingham cobbly loam, 6 to 10 percent slopes	2	3	---	---	---	---	---	---
Bingham cobbly loam, 6 to 10 percent slopes 2/	1	1¼	---	---	---	---	---	---
Bramwell silty clay loam	1½	2½	---	---	---	---	30	45
Bramwell silty clay loam, drained	3½	5	13	18	4	5	60	100
Chipman loam	4	6	14	20	4	6	70	110
Chipman silty clay loam	4	6	16	23	4	7	70	110
Chipman silty clay loam, moderately deep water table	---	---	---	---	---	---	---	---
Chipman silty clay loam, moderately saline	1½	2½	---	---	---	---	30	50
Chipman silty clay loam, strongly saline 1/	---	---	---	---	---	---	---	---
Cleverly cobbly sandy loam, 6 to 15 percent slopes	2	3	---	---	---	---	---	---
Cleverly gravelly fine sandy loam, 1 to 3 percent slopes	3	4	---	---	---	---	50	60
Cleverly gravelly fine sandy loam, 3 to 6 percent slopes	2½	3½	---	---	---	---	40	60
Cleverly gravelly fine sandy loam, 3 to 6 percent slopes 2/	3/4	1	---	---	---	---	---	---
Cleverly gravelly fine sandy loam, 6 to 15 percent slopes	2	3	---	---	---	---	---	---
Cleverly gravelly fine sandy loam, 6 to 15 percent slopes 2/	3/4	1	---	---	---	---	---	---
Dagor loam	4½	6	16	22	4	5	60	100
Dagor silt loam	4½	6	18	25	---	---	65	100
Hillfield silt loam, 10 to 20 percent slopes 2/	½	1	---	---	---	---	---	---
Hillfield silt loam, 20 to 30 percent slopes 2/	1	1½	---	---	---	---	---	---
Holdaway silt loam	3	4	10	14	4	6	70	90
Holdaway silt loam, strongly saline-alkali 1/	---	---	---	---	---	---	---	---
Ironton loam	4	6	14	20	4	6	70	110
Ironton loam, moderately saline-alkali	3	4½	---	---	---	---	50	90
Jordan silt loam 1/	---	---	---	---	---	---	---	---
Keigley silty clay loam, 0 to 1 percent slopes	4	6	14	22	4	7	60	110
Keigley silty clay loam, 1 to 3 percent slopes	4	6	14	22	4	7	60	110
Keigley silty clay loam, extended season, 0 to 2 percent slopes	4	6	14	22	4	7	60	110
Kidman very fine sandy loam, 0 to 1 percent slopes	4½	6	14	22	4	7	70	100
Kidman very fine sandy loam, 1 to 3 percent slopes	4½	6	14	22	4	7	70	100
Kidman very fine sandy loam, 3 to 6 percent slopes	3	5	---	---	---	---	50	90
Kirkham silty clay loam	4	6	15	20	4	7	70	110
Kirkham silty clay loam, moderately saline-alkali	2	3	---	---	---	---	30	45

See footnotes at end of table.

a moderately high level of management. Absence of yield indicates crop is seldom grown on the soil specified]

Wheat		Sugar beets		Pasture for beef cattle		Peaches		Apples		Sweet cherries		Pears	
A	B	A	B	A	B	A	B	A	B	A	B	A	B
Bu.	Bu.	Tons	Tons	Lbs.	Lbs.	Bu.	Bu.	Bu.	Bu.	Tons	Tons	Bu.	Bu.
50	80	12	18	500	800	---	---	---	---	---	---	---	---
---	---	---	---	400	500	---	---	---	---	---	---		
---	---	---	---	100	200	---	---	---	---	---	---	---	---
50	80	12	18	500	800	---	---	---	---	---	---	---	---
30	45	---	---	300	600	400	540	350	500	3	4½	350	500
30	45	---	---	300	600	400	540	350	500	3	4½	350	500
---	---	---	---	---	---	400	540	350	500	3	4½	---	---
---	---	---	---	50	70	---	---	---	---	---	---	---	---
---	---	---	---	---	---	400	540	350	500	3	4½	---	---
---	---	---	---	50	70	---	---	---	---	---	---	---	---
---	---	10	13	250	400	---	---	---	---	---	---	---	---
45	60	15	20	500	800	---	---	---	---	---	---	---	---
50	70	17	25	500	800	---	---	---	---	---	---	---	---
50	70	18	25	500	800	---	---	---	---	---	---	---	---
---	---	---	---	500	800	---	---	---	---	---	---	---	---
---	---	10	15	400	700	---	---	---	---	---	---	---	---
---	---	---	---	100	200	---	---	---	---	---	---	---	---
---	---	---	---	300	600	400	540	350	500	3	4½	350	500
30	45	---	---	300	600	400	540	350	500	3	4½	350	500
25	40	---	---	300	600	400	540	350	500	3	4½	350	500
11	15	---	---	40	60	---	---	---	---	---	---	---	---
---	---	---	---	300	600	400	540	350	500	3	4½	---	---
11	15	---	---	40	60	---	---	---	---	---	---	---	---
55	75	17	25	500	800	---	---	350	500	---	---	---	---
55	75	---	---	500	800	---	---	350	500	---	---	---	---
9	12	---	---	30	50	---	---	---	---	---	---	---	---
14	18	---	---	60	80	---	---	---	---	---	---	---	---
45	60	14	18	500	800	---	---	---	---	---	---	---	---
---	---	---	---	100	200	---	---	---	---	---	---	---	---
50	70	16	25	500	800	---	---	---	---	---	---	---	---
---	---	10	20	400	750	---	---	---	---	---	---	---	---
---	---	---	---	100	200	---	---	---	---	---	---	---	---
50	75	17	25	500	900	---	---	---	---	---	---	---	---
50	75	17	25	500	900	---	---	---	---	---	---	---	---
50	75	17	25	500	900	---	---	350	500	---	---	350	500
50	75	17	25	500	800	400	540	350	500	3	4½	350	500
50	75	17	25	500	800	400	540	350	500	3	4½	350	500
45	65	---	---	400	700	400	540	350	500	3	4½	350	500
45	80	16	22	500	800	---	---	---	---	---	---	---	---
---	---	10	14	400	500	---	---	---	---	---	---	---	---

TABLE 1.--ESTIMATED AVERAGE ACRE YIELDS OF PRINCIPAL

Soil	Alfalfa		Corn (silage)		Sweet corn		Barley	
	A	B	A	B	A	B	A	B
	Tons	Tons	Tons	Tons	Tons	Tons	Bu.	Bu.
Kirkham silty clay loam, strongly saline-alkali-	---	---	---	---	---	---	---	---
Lakewin gravelly fine sandy loam, 1 to 6 percent slopes	3	4	---	---	---	---	45	65
Lakewin gravelly fine sandy loam, 6 to 15 percent slopes	---	---	---	---	---	---	---	---
Layton loamy fine sand, 6 to 15 percent slopes-	2	3	---	---	---	---	---	---
Layton fine sandy loam, 1 to 6 percent slopes--	3	4	14	16	3	4	50	60
Layton fine sandy loam, slowly permeable substratum, 0 to 1 percent slopes	4	5	16	20	3	5	60	80
Layton fine sandy loam, water table, 1 to 3 percent slopes	4	5	16	20	3	5	60	80
Logan silty clay loam 1/	---	---	---	---	---	---	---	---
Logan silty clay loam, heavy variant 1/	2	3	---	---	---	---	---	---
Martini fine sandy loam	4½	6	14	22	4	6	60	110
McBeth silt loam	5	6	18	25	5	7	80	120
McBeth silt loam, moderately saline	3	4½	---	---	---	---	60	90
McMurdie silt loam, 3 to 6 percent slopes 2/---	1	1½	---	---	---	---	---	---
McMurdie-Taylorsville complex, 6 to 20 percent slopes, eroded 2/	1	1½	---	---	---	---	---	---
Parleys loam, 0 to 3 percent slopes	4½	6	18	25	4	7	70	110
Parleys loam, 0 to 3 percent slopes 2/	1	1½	---	---	---	---	---	---
Parleys loam, 3 to 6 percent slopes	3	5	---	---	---	---	50	80
Parleys loam, 3 to 6 percent slopes 2/	1	1½	---	---	---	---	---	---
Parleys gravelly loam, overwashed, 3 to 6 percent slopes	2	3	---	---	---	---	35	60
Parleys silty clay loam, 0 to 3 percent slopes-	4½	6	18	25	4	7	70	110
Payson silty clay loam	2	3	---	---	---	---	40	50
Peteetneet peat 1/	---	---	---	---	---	---	---	---
Pleasant Grove gravelly loam, 3 to 6 percent slopes	2	3	---	---	---	---	40	60
Pleasant Grove gravelly loam, 6 to 10 percent slopes	---	---	---	---	---	---	---	---
Pleasant Grove stony loam, 10 to 25 percent slopes, eroded	---	---	---	---	---	---	---	---
Pleasant Vale loam, 0 to 2 percent slopes	4½	6	18	25	4	7	70	100
Pleasant Vale loam, extended season, 0 to 2 percent slopes	4½	6	18	25	4	7	70	100
Pleasant Vale loam, extended season, 3 to 6 percent slopes	3	4	---	---	---	---	50	80
Pleasant Vale gravelly loam, extended season, 1 to 3 percent slopes	3	4	16	20	3	4	50	80
Pleasant Vale gravelly sandy loam, extended season, 6 to 10 percent slopes 2/	3/4	1	---	---	---	---	---	---
Pleasant Vale silty clay loam, 1 to 3 percent slopes	4	6	18	25	4	7	70	100
Pleasant View fine sandy loam, 1 to 3 percent slopes	3	4½	10	15	---	---	50	80
Preston fine sand, 1 to 10 percent slopes	2	3	---	---	---	---	---	---
Preston loamy fine sand, high water table variant	---	---	---	---	---	---	---	---
Provo gravelly fine sandy loam	2	3	12	14	3	4	40	60
Redola loam, 0 to 3 percent slopes	4	6	18	25	4	7	70	100
Redola gravelly loam, 3 to 6 percent slopes 2/-	---	---	---	---	---	---	---	---
Steed sandy loam	3	4	12	14	3	4	40	50
Steed gravelly sandy loam	2½	3½	---	---	---	---	35	50
Sterling gravelly fine sandy loam, 1 to 3 percent slopes	3	4	10	15	---	---	40	50

See footnotes at end of table.

CROPS, PASTURE, AND FRUIT TREES --Continued

Wheat		Sugar beets		Pasture for beef cattle		Peaches		Apples		Sweet cherries		Pears	
A	B	A	B	A	B	A	B	A	B	A	B	A	B
Bu.	Bu.	Tons	Tons	Lbs.	Lbs.	Bu.	Bu.	Bu.	Bu.	Tons	Tons	Bu.	Bu.
---	---	---	---	100	200	---	---	---	---	---	---	---	---
25	40	---	---	300	600	400	540	350	500	3	4½	350	500
---	---	---	---	200	500	400	540	350	500	3	4½	350	500
---	---	---	---	200	500	400	540	350	500	3	4½	350	500
40	50	---	---	400	700	400	540	350	500	3	4½	350	500
40	70	10	16	400	800	---	---	---	---	---	---	---	---
40	70	10	16	400	800	---	---	---	---	---	---	---	---
---	---	---	---	200	400	---	---	---	---	---	---	---	---
---	---	---	---	400	600	---	---	---	---	---	---	---	---
50	75	17	25	500	900	---	---	---	---	---	---	---	---
50	75	18	25	500	900	---	---	350	500	---	---	---	---
---	---	14	20	300	750	---	---	---	---	---	---	---	---
17	22	---	---	60	80	---	---	---	---	---	---	---	---
17	22	---	---	60	80	---	---	---	---	---	---	---	---
60	80	18	27	500	900	400	540	350	500	---	---	350	500
17	22	---	---	60	80	---	---	---	---	---	---	---	---
40	60	---	---	400	700	---	---	350	500	---	---	350	500
17	22	---	---	60	80	---	---	---	---	---	---	---	---
25	40	---	---	300	500	---	---	350	500	---	---	350	500
60	80	18	26	500	900	---	---	350	500	---	---	---	---
---	---	---	---	300	500	---	---	---	---	---	---	---	---
---	---	---	---	300	500	---	---	---	---	---	---	---	---
25	40	---	---	300	500	400	540	350	500	3	4½	350	500
---	---	---	---	300	500	400	540	350	500	3	4½	350	500
---	---	---	---	200	400	400	540	350	500	3	4½	350	500
60	80	18	27	600	900	---	---	---	---	---	---	---	---
60	80	18	27	600	900	---	---	350	500	---	---	---	---
40	60	---	---	400	700	---	---	350	500	---	---	---	---
40	60	---	---	400	700	---	---	350	500	---	---	---	---
10	14	---	---	40	60	---	---	---	---	---	---	---	---
60	80	16	25	600	900	---	---	---	---	---	---	---	---
40	55	---	---	300	600	---	---	350	500	3	4½	---	---
---	---	---	---	200	300	300	400	---	---	2	3	---	---
---	---	---	---	200	400	---	---	---	---	---	---	---	---
---	---	---	---	300	600	---	---	---	---	---	---	---	---
60	80	18	27	500	900	---	---	300	500	---	---	---	---
15	15	---	---	40	60	---	---	---	---	---	---	---	---
25	40	---	---	300	500	---	---	350	500	---	---	---	---
30	45	---	---	200	400	---	---	350	500	3	4	---	---
25	40	---	---	400	600	400	500	350	500	3	4½	350	500

TABLE 1.--ESTIMATED AVERAGE ACRE YIELDS OF PRINCIPAL

Soil	Alfalfa		Corn (silage)		Sweet corn		Barley	
	A	B	A	B	A	B	A	B
	Tons	Tons	Tons	Tons	Tons	Tons	Bu.	Bu.
Sterling gravelly fine sandy loam, 3 to 6 percent slopes	2	3	---	---	---	---	30	40
Sterling gravelly fine sandy loam, 6 to 10 percent slopes	2	3	---	---	---	---	30	40
Sunset loamy fine sand	2	3	---	---	---	---	40	60
Sunset loam	4	6	18	25	4	7	70	110
Sunset loam, gravelly substratum	4	5	18	24	4	5	70	100
Sunset loam, clay substratum	4½	6	18	25	4	7	70	100
Sunset loam, moderately saline	2	3	---	---	---	---	50	70
Taylorsville silty clay loam, 0 to 1 percent slopes	4	5½	14	23	4	5	60	110
Taylorsville silty clay loam, 1 to 3 percent slopes	4	5½	14	23	4	5	60	110
Taylorsville silty clay loam, extended season, 0 to 1 percent slopes	4	5½	14	23	4	5	60	110
Taylorsville silty clay loam, extended season, 1 to 3 percent slopes	4	5½	14	23	4	5	60	110
Taylorsville silty clay loam, extended season, 3 to 6 percent slopes 2/	1	1½	---	---	---	---	---	---
Timpanogos loam, 0 to 3 percent slopes	4½	6	18	25	4	7	70	110
Timpanogos loam, 3 to 6 percent slopes	3	5	---	---	---	---	59	80
Timpanogos loam, water table, 0 to 3 percent slopes	4	6	18	25	4	7	70	100
Vineyard fine sandy loam, 0 to 2 percent slopes	4	5	16	22	4	5	60	100
Vineyard fine sandy loam, 0 to 2 percent slopes	1½	2	---	---	---	---	30	45
Welby silt loam, 0 to 1 percent slopes	4	6	16	23	4	7	70	110
Welby silt loam, 1 to 3 percent slopes	4	6	16	23	4	7	70	110
Welby silt loam, 3 to 6 percent slopes	3	5	---	---	---	---	60	80
Welby silt loam, extended season, 0 to 1 percent slopes	4	6	16	23	4	7	80	110
Welby silt loam, extended season, 1 to 3 percent slopes	4	6	16	23	4	7	80	110
Welby silt loam, extended season, 1 to 3 percent slopes 2/	1	1½	---	---	---	---	---	---
Welby silt loam, extended season, 3 to 6 percent slopes	3	5	---	---	---	---	60	80
Welby silt loam, extended season, 3 to 6 percent slopes 2/	1	1½	---	---	---	---	---	---
Welby silt loam, extended season, 6 to 10 percent slopes 2/	1	1½	---	---	---	---	---	---

1/ Subirrigated lowlands.

CROPS, PASTURE, AND FRUIT TREES --Continued

Wheat		Sugar beets		Pasture for beef cattle		Peaches		Apples		Sweet cherries		Pears	
A	B	A	B	A	B	A	B	A	B	A	B	A	B
Bu.	Bu.	Tons	Tons	Lbs.	Lbs.	Bu.	Bu.	Bu.	Bu.	Tons	Tons	Bu.	Bu.
20	35	---	---	300	500	400	500	350	500	3	4½	350	500
---	---	---	---	200	400	400	500	350	500	3	4½	350	500
---	---	10	12	200	450	---	---	---	---	---	---	---	---
60	80	18	27	500	900	---	---	---	---	---	---	---	---
60	70	16	26	450	850	---	---	---	---	---	---	---	---
60	80	18	27	600	900	---	---	---	---	---	---	---	---
---	---	10	22	400	600	---	---	---	---	---	---	---	---
40	60	15	20	600	900	---	---	---	---	---	---	---	---
40	60	15	20	600	900	---	---	---	---	---	---	---	---
40	60	15	20	600	900	---	---	350	400	---	---	---	---
40	60	15	20	600	900	---	---	350	400	---	---	---	---
14	18	---	---	60	75	---	---	---	---	---	---	---	---
60	80	18	27	600	900	400	540	350	500	3	4½	350	500
40	60	---	---	400	700	400	540	350	500	3	4½	350	500
60	80	18	27	600	900	---	540	---	500	---	4½	---	500
60	80	18	24	500	900	---	---	---	---	---	---	---	---
---	---	10	14	400	600	---	---	---	---	---	---	---	---
50	70	18	25	600	900	---	---	---	---	---	---	---	---
50	70	18	25	600	900	---	---	---	---	---	---	---	---
40	60	---	---	400	700	---	---	---	---	---	---	---	---
50	70	18	25	600	900	400	540	350	500	3	4½	350	500
50	70	18	25	600	900	400	540	350	500	3	4½	350	500
14	22	---	---	60	80	---	---	---	---	---	---	---	---
40	60	---	---	400	700	400	540	350	500	3	4½	350	500
14	22	---	---	60	80	---	---	---	---	---	---	---	---
12	18	---	---	60	80	---	---	---	---	---	---	---	---

2/ For nonirrigated crops only.

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sampling and testing at the site of specific engineering works involving heavy loads or where the excavations are deeper than the depth of layers here reported. Even in these situations, however, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

The information in this soil survey is based on soil test data, which should be considered when evaluating a soil for a specific purpose. The information given applies only to the depth of the soil given in table 2 under the heading "Depth from surface".

Engineering Classification Systems

Three systems of soil classification are used in this section. They are the U.S. Department of Agriculture (USDA) textural classification system used by the Soil Conservation Service (12), the Unified system used by the Department of Defense and others (15), and the system adapted by the American Association of State Highway Officials (AASHO) (1).

The USDA classification system has terms used by soil scientists that should be understood in reading this soil survey. These and other special terms are defined in the Glossary at the back of this survey or in the "Soil Survey Manual" (12).

The AASHO system of classifying soils is an engineering property classification based on field performance of highways. It is the most widely known system used in highway construction.

Under this system, grouping soils of about the same general load-carrying capacity and service characteristics resulted in seven basic groups that were designated A-1 through A-7. The best soils for road subgrades are classified as A-1, the next A-2, and so on to class A-7, the poorest soils for subgrade.

The terms "silt" and "clay", as used in the engineering classification are different from those used in the USDA classification system, where they are used for textural classes of soils. In the AASHO system engineers use the terms "silty" to identify fine material that has a plasticity index of 10 or less; the term "clayey" is applied to fine material that has a plasticity index of more than 10.

The Unified system is based on the soil classification system developed by Dr. Arthur Cesagrande, of Harvard University, for the Corps of Engineers during World War II. The original classification has been expanded and revised in cooperation with the U.S. Bureau of Reclamation so that it now applies to embankments and foundations as well as to roads and airfields. It is used by the Corps of Engineers, Bureau of Reclamation, and by the Soil Conservation Service.

In the Unified system, soils are identified according to their texture and plasticity and are grouped according to their performance as engineering construction material. Soil material is classified as coarse grained, which are gravels (G) and sands (S); fine grained, which are silts (M) and clays (C); and highly organic (O). In this system clean sands are identified by the symbols SW and SP; sands with fines of silt and clay, by SM and SC; silts and clays having low liquid limit, by ML and CL; and silts and clays having high liquid limit, by MH and CH.

Estimated Engineering Properties of Soils

Table 2 provides estimates of soil properties important in engineering. The estimates are based on field classification, descriptions of the soils, laboratory tests of samples representative of the soils is this survey area, comparable soils in adjacent areas, and experience gained in working with the soils in the survey area.

Depth to bedrock is not given in table 2. Except for the soils in the Holdaway, Picayune, red variant, and Rake series, depth to bedrock is more than 5 feet in all of the soils in this survey area.

Depth to a seasonal water table refers to the depth from the surface to the water table in undrained areas at the time this survey was made.

The soils in this survey area have been placed in four hydrologic soil groups. These groups are used for estimating the runoff potential of soils. Groupings are based on soil properties that influence runoff. The potential is calculated on water intake at the end of a long-duration storm that occurs after prior wetting and opportunity for swelling of a soil not protected by vegetation. In group A are soils that have a high rate of infiltration when they are thoroughly wet. These soils are mainly deep, well-drained to excessively drained sands or gravelly soils. The rate of water transmission is high, therefore runoff potential is low. In group B are soils that have a moderate rate of infiltration when thoroughly wet. These soils are moderately deep or deep, moderately well drained or well drained, and moderately fine textured to moderately coarse textured. In group C are soils that have a slow rate of infiltration when thoroughly wet. Most of these soils contain a layer that impedes the downward movement of water or soils that have moderately fine texture and a slow infiltration rate. These soils transmit water slowly. The soils in group D have a very slow rate of infiltration. They are mainly clays that have high swelling potential, soils that have a claypan or a clay layer at or near the surface, or soils that are shallow over nearly impervious material. The soils in group D transmit water very slowly.

The dominant USDA texture and the estimated Unified and AASHO classifications for each major horizon in a typical profile are listed in table 2. The USDA textural classification is made on the basis of the proportions of sand, silt, and clay in the soil.

The columns headed "Percentage passing sieve" show the percentage of soil material smaller than 3 inches that passes the openings of Nos. 4, 10, and 200 sieves.

Permeability is the rate of water percolation in the soil, expressed in inches per hour. Permeability depends mainly on texture, structure, and porosity of the soil, but it may also be affected by other physical properties.

Available water capacity, expressed as inches of water per inch of soil, is the capacity of soils to hold water available for use by most plants. It is the difference between the amount of soil water at field capacity and the amount at wilting point.

Reaction, the degree of acidity or alkalinity of a soil, is expressed as a pH value. A pH of 7.0 is neutral; values lower than 7.0 are acid, and values higher are alkaline. The pH value and corresponding terms used to describe soil reaction are defined in the Glossary.

Salinity refers to the degree of salinity that can be expected in the soil.

Shrink-swell potential indicates the volume change to be expected in the soil material that results from change in moisture content.

Engineering Interpretations of Soils

In table 3 most of the soils in this survey area are rated according to their suitability as sources of topsoil, sand, gravel, and road fill and according to the degree of their limitations when used as septic tank filter fields and foundations for low buildings. Table 3 also names the soil features that affect the location of highways and the construction and maintenance of farm ponds, drainage systems, and irrigation systems. The ratings and other interpretations in this table are based on the test data given in table 4 and on field experiences. They are general and should be used primarily for planning more detailed field investigations to determine the characteristics of the soil material at the specific site of the proposed engineering work.

A rating of excellent, good, fair, poor, or not suitable is given to show suitability of soil material as a source of topsoil, sand, gravel, and road fill. A rating of not suitable means that the soil material generally is not considered as a source of material for that specific use. Considered in rating the soils as a source of topsoil is the content of clay, salt, alkali, lime, gravel, stones, and silt.

The suitability of soils as a source of material for road fill is affected by their susceptibility to frost action, shrink-swell potential, depth to the soil material, depth to bedrock, and content of salt and clay.

The selection of highway locations is affected by susceptibility of the soil to frost action and to flooding, height of the water table, shrink-swell potential, plasticity, the degree of the slope, and the salt content.

Among the soil features affecting reservoir areas of farm ponds are permability, stability, and the degree of the slope.

Some of the important features that affect the suitability of soil material for embankments are strength and stability, content of stones, gravel, salt, sand, and silt.

Soil features affecting agricultural drainage include availability of outlets and permeability of the soil.

Some of the features considered when evaluating a soil for irrigation purposes were available water capacity, rate of water intake, salinity of the soil material, the degree of the slope, and drainage.

The estimated degree and kinds of soil limitations for septic tank filter fields and as foundations for low buildings are also given in table 3. The limitations are rated slight, moderate, or severe. If the limitation is moderate or severe, the main limiting property or properties are given.

Among the properties considered in rating the limitations for septic tank filter fields were depth to the water table, permeability, the degree of the slope, and the hazard of flooding.

Considered in rating the soils according to their limitations to use as foundations for low buildings were depth to the water table, shrink-swell potential and bearing strength of the soil material, the hazard of flooding, and the degree of the slope.

Engineering Test Data

In table 4 are data from engineering tests performed by the Bureau of Public Roads and the State Road Commission of Utah on some of the soils in this survey area. This table shows the specific location from which the samples were taken, the depth to which the sampling was done, and the results of the tests that determine particle-size distribution and other properties significant in soil engineering.

Mechanical analyses show the percentages, by weight, of soil particles that pass sieves of specified sizes.

The tests for liquid limit and plasticity index measure the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range in moisture content within which a soil material is plastic.

The engineering classifications given in table 4 are based on data obtained by mechanical analyses and on the results of tests to determine the liquid limit and plasticity index.

TABLE 2.--ESTIMATED

[Absence of data indicates

Soil series and map symbols	Depth to seasonal water table	Hydrologic group	Depth from surface (typical profile)	Classification		
				Dominant USDA texture	Unified	AASHO
	In.		In.			
Arave: AR----------	20-40	D	0-5	Silt loam---------	ML	A-4
			5-28	Silty clay loam---	CL	A-6
			28-42	Silt loam---------	ML	A-4
			42-60	Loamy very fine sand.	SM or ML	A-4
Beaches: BC. No valid estimates can be made.						
Bengamin: Bd, Bg, Be, Bf.	30-60	D	0-52	Silty clay--------	ML or CL	A-7
				Silty clay--------	ML or CL	A-7
				Silty clay--------	ML or CL	A-7
Bingham: BkB, BhB, BmC, BmD.	>60	B	0-18	Gravelly loam or gravelly sandy clay loam.	SC	A-4
			18-40	Very gravelly sandy loam and sand.	GW or GW-GM	A-1
Bramwell: Br, Bs----	30-50	C	0-60	Silty clay loam---	CL	A-6 or A-7
Chipman:						
Ck, Ch, Cm, Cp----- For McBeth part of Cp, refer to the McBeth series.	20-60	C	0-60	Silty clay loam, loam, or clay loam.	CL or ML	A-6 or A-7
Cn----------	20-60	C	0-60	Silty clay loam, loam, or clay loam.	ML or CL	A-4 or A-6
Co----------	20-60	C	0-60	Silty clay loam, loam, or clay loam.	ML or CL	A-4 or A-6
Cleverly: CrD, CsB, CsC, CsD.	<60	A	0-56	Gravelly loam to gravelly sandy loam.	SM	A-2
Cobbly alluvial land: CU. No valid estimates can be made.						
Dagor: Da, Db-------	>60	B	0-60	Loam----------	ML	A-4

See footnotes at end of table.

estimates were not made]

Percentage passing sieve--			Percentage larger than 3 inches	Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
				In./hr.	In./in. of soil	pH		
100	95-100	75-85	------	0.2-0.8	0.03-0.04	7.4-8.4	High-------	Low.
100	100	80-90	------	0.05-0.2	0.02-0.04	8.5-9.0	Very high--	Moderate.
100	100	80-90	------	0.2-0.8	0.02-0.04	7.9-9.0	Very high--	Low.
100	100	40-60	------	5.0-10.0	0.02-0.04	7.9-9.0	Very high--	Low.
100	100	90-100	------	0.05-0.2	0.17-0.20	7.9-8.4	None to low.	High.
100	100	90-100	------	0.05-0.2	0.10-0.14	8.4-9.0	High-------	High.
100	100	90-100	------	0.05-0.2	0.02-0.04	8.4-9.0	Very high--	High.
65-75	60-70	35-45	0-10	2.5-5.0	0.08-0.11	6.6-7.3	None-------	Low.
25-35	20-30	2-10	20	5.0-10.0	0.04-0.06	7.4-8.4	None-------	Low.
100	100	85-100	------	0.05-0.2	0.13-0.17	7.8-8.5	Low to high.	Moderate.
100	100	85-95	------	0.2-0.8	0.17-0.21	7.4-8.0	Low--------	Moderate.
100	100	75-95	------	0.2-0.8	0.14-0.17	8.5-9.0	High-------	Low.
100	100	75-95	------	0.2-0.8	0.04-0.07	8.5-9.0	Very high--	Low.
75-85	50-70	25-35	5-15	5.0-10.0	0.07-0.10	6.6-7.3	None-------	Low.
90-100	90-100	50-80	------	0.8-2.5	0.17-0.20	6.6-7.8	None-------	Low.

TABLE 2.--ESTIMATED PROPERTIES

Soil series and map symbols	Depth to seasonal water table	Hydrologic group	Depth from surface (typical profile)	Classification		
				Dominant USDA texture	Unified	AASHO
	In.		In.			
Dry Creek: DCF, DRG2---	>60	C	0-9	Cobbly loam----------	CL or SC	A-4
			9-26	Cobbly clay----------	CH	A-7
			26-48	Very cobbly clay loam--	GC or SC	A-2
Dry Creek, stony variant: DEF.	>60	B	0-30	Very cobbly clay loam--	GC or SC	A-2
			30-60	Very cobbly sandy loam-	GM or SM	A-2
Gappmayer: GAG---------	>60	A	0-63	Cobbly loam to very cobbly loam.	GM or SM	A-2
Henefer: HEG, HFF, HFG2, HKG. For McPhie part of HFF and HFG2 and for Rake part of HKG, refer to the McPhie and Rake series respectively.	>60	C	0-15	Loam, clay loam, and cobbly loam.	CL	A-4
			15-43	Cobbly clay----------	CH or GC	A-7
			43-65	Very cobbly clay-------	GC or SC	A-7 or A-2
Hillfield: HmE, HmF, HNG, HpF, HOF. For Layton part of HNG, Sterling part of HOF, and Welby part of HpF, refer to their respective series.	>60	B	0-40	Silt loam and loam-----	ML	A-4
			40-60	Sandy loam----------	SM	A-2 or A-4
Holdaway:						
Hr------------------	30-40	D	0-20	Silt loam----------	ML	A-4
			20-67	Indurated hardpan interlayered with silt loam at depth of 20 to 40 inches.	----------	----------
Hs------------------	30-40	D	0-29	Loam----------	ML	A-4
			29-55	Lime hardpan----------	----------	----------
Ironton:						
Ir------------------	30-60	(1/)	0-60	Loam and very fine sandy loam.	ML or CL	A-4
Is------------------	30-60	(1/)	0-60	Loam and very fine sandy loam.	ML or CL	A-4
Jordan: Jo----------	30-60	D	0-7	Silt loam----------	ML or CL	A-4
			7-15	Clay----------	CL or CH	A-7
			15-60	Silty clay loam--------	CL	A-7
Keigley: KeA, KeB, KgA-	>60	C	0-65	Silty clay loam--------	CL	A-7 or A-6
Kidman: KmA, KmB, KmC--	>60	B	0-60	Very fine sandy loam to loam.	ML or CL-ML	A-4

See footnotes at end of table

OF SOILS--Continued

Percentage passing sieve--			Percentage larger than 3 inches	Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
				In./hr.	In./in. of soil	pH		
55-85	50-80	35-65	20-50	0.8-2.5	0.07-0.09	5.5-6.5	None--------	Low.
55-85	50-80	50-70	20-50	0.05-0.20	0.08-0.10	5.5-6.5	None--------	Moderate.
25-55	20-50	10-30	35-60	0.20-0.8	0.06-0.08	7.4-8.4	None--------	Low.
25-55	20-50	10-30	50-80	0.8-2.5	0.06-0.08	6.5-7.3	None--------	Low.
25-55	20-50	5-15	50-80	>5.0	0.05-0.07	7.4-7.8	None--------	Low.
35-55	30-50	10-25	50-70	5.0-10.0	0.04-0.06	6.1-7.3	None--------	Low.
75-100	70-100	50-70	0-30	0.8-2.5	0.14-0.16	6.1-7.3	None--------	Low to moderate.
55-85	50-80	45-70	20-50	0.05-0.2	0.10-0.13	6.1-6.5	None--------	Moderate.
25-55	20-50	20-45	50-80	0.05-0.2	0.06-0.08	6.1-7.3	None--------	Low.
90-100	85-95	55-80	------	0.8-2.5	0.17-0.20	7.4-9.0	None--------	Low.
90-100	85-95	30-40	------	2.5-5.0	0.15-0.18	8.5-9.0	None--------	Low.
100	100	85-95	------	0.2-0.8	0.17-0.20	7.4-8.4	Low---------	Low.
------	------	-----	------	<0.05	---------	7.4-8.4	----------	
100	100	65-75	------	0.2-0.8	0.05-0.06	8.5-9.0	Very high---	Low.
------	------	-----	------	<0.05	---------	-------	----------	
100	100	55-80	------	0.8-2.5	0.17-0.21	7.4-8.4	Low---------	Low
100	100	55-80	------	0.8-2.5	0.10-0.13	7.4-8.4	High--------	Low.
100	100	65-85	------	0.2-0.8	0.16-0.19	7.8-9.0	High--------	Low.
100	100	75-95	------	<0.05	0.01-0.02	9.5-10.5	Very high---	High.
100	100	90-100	------	<0.5	0.01-0.02	9.5-10.5	Very high---	Moderate.
100	100	90-100	------	0.20-0.8	0.17-0.20	7.4-8.4	None to low-	Moderate.
100	100	55-65	------	0.8-2.5	0.11-0.19	7.4-8.4	None--------	Low.

TABLE 2.--ESTIMATED PROPERTIES

Soil series and map symbols	Depth to seasonal water table	Hydrologic group	Depth from surface (typical profile)	Classification		
				Dominant USDA texture	Unified	AASHO
	In.		In.			
Kilburn: KNG2, KOD, KRE2.	>60	A	0-15	Gravelly, very gravelly or stony sandy loam.	SM	A-2
			15-60	Very gravelly sandy loam.	SM or GM	A-2
Kirkham: Ks, Kt, Ku----	30-40	C	0-28	Silty clay loam--------	CL or ML	A-6 or A-7
			28-42	Silty clay------------	CH or CL	A-7
			42-65	Silt loam--------------	ML or CL	A-4 or A-6
Lakewin: LaC, LaD, LcE-	>60	A	0-27	Gravelly fine sandy loam.	SM	A-2
			27-60	Very gravelly sand-----	GW or GP	A-1
Layton: LfC, LeD, LmA---------	>60	A	0-39	Loamy fine sand to fine sandy loam.	SM	A-2 or A-4
			39-57	Fine sand--------------	SP-SM or SM	A-3 or A-1
LnB----------	36-60	A	0-36	Loamy fine sand--------	SM	A-2 or A-4
			36-60	Silty clay loam--------	CL	A-6
Logan: Lo----------	12-40	D	8-0	Peat-------------------	Pt	----------
			0-77	Silty clay loam, silt loam, or silty clay.	CL or CH	A-6 or A-7
Logan: heavy variant: Ls.	20-40	D	0-60	Silty clay loam or silty clay.	CH or CL	A-7 or A-6
Manila: MAF----------	>60	C	0-17	Clay loam or silt loam-	CL or ML	A-4 or A-6
			17-42	Silty clay------------	CL or CH	A-7
			42-63	Cobbly clay loam-------	CL	A-7
Martini: Mf----------	40-60	B	0-17	Fine sandy loam--------	CM	A-4
			17-60	Light sandy loam or loamy fine sand.	SM	A-2
McBeth:						
Mh----------	20-50	(1/)	0-68	Silt loam--------------	ML or CL	A-4
Mn----------	20-50	C	0-60	Silt loam--------------	ML or CL	A-4
McMurdie: MrC, MtE2----	>60	C	0-11	Silt loam--------------	ML or CL	A-4
			11-47	Silty clay------------	CL, CH, or MH	A-7
			47-63	Silty clay loam--------	CL	A-6 or A-7
McPhie---------- (Mapped only with Henefer soils.)	>60	B	0-60	Cobbly loam to gravelly sandy loam; loam to a depth of 12 inches in some places.	SM or SC	A-2, A-4
Mixed alluvial land: MU, MX. No valid estimates can be made.						

See footnotes at end of table.

OF SOILS--Continued

Percentage passing sieve--			Percentage larger than 3 inches	Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
				In./hr.	In./in. of soil	pH		
75-85	40-70	20-30	20-30	2.5-5.0	0.06-0.09	6.6-7.3	None	Low.
65-75	40-60	10-20	30-40	5.0-10.0	0.03-0.05	6.6-7.3	None	Low.
100	100	75-95	-----	0.2-0.8	0.17-0.20	7.8-8.4	Low	Moderate.
100	100	90-100	-----	0.2-0.8	0.16-0.19	7.8-8.4	Low	High.
100	100	70-90	-----	0.2-0.8	0.16-0.19	7.8-9.0	Low	Low to moderate.
70-80	65-75	20-30	5-10	2.5-5.0	0.07-0.10	6.6-7.3	None	Low.
35-45	30-40	0-5	10-20	5.0-10.0	0.01-0.05	7.4-8.4	None	Low.
95-100	95-100	25-40	-----	5.0-10.0	0.07-0.09	7.0-8.4	None	Low.
100	100	5-20	-----	>10.0	0.03-0.05	7.9-8.4	None	Low.
95-100	95-100	25-40	-----	5.0-10.0	0.07-0.09	7.0-8.4	None	Low.
100	100	85-95	-----	0.05-0.2	0.17-0.19	7.8-8.4	None	Moderate.
------	------	-----	-----	0.8-2.5	0.25-0.35	6.5-7.0	None to low-	
100	100	95-100	-----	0.05-0.2	0.16-0.19	6.6-7.3	None to low-	Moderate.
100	100	95-100	-----	0.05-0.2	0.16-0.19	7.4-7.8	None to low-	High.
100	100	85-95	-----	0.8-2.5	0.17-0.20	6.6-7.3	None	Moderate.
100	100	90-100	0-5	0.05-0.2	0.16-0.18	5.6-6.5	None	High.
60-85	55-80	50-70	20-50	0.2-0.8	0.10-0.15	6.1-7.3	None	Moderate.
100	100	40-50	-----	2.5-5.0	0.13-0.15	7.4-7.8	None	Low.
100	100	25-35	-----	5.0-10.0	0.09-0.13	7.4-7.8	None	Low.
100	100	75-85	-----	2.5-5.0	0.16-0.19	7.4-8.4	Low	Low.
100	100	75-85	-----	2.5-5.0	0.12-0.14	7.4-8.4	Moderate	Low.
100	100	75-95	-----	0.2-0.8	0.17-0.20	7.0-7.8	None	Low.
100	100	95-100	-----	0.2-0.8	0.16-0.18	7.4-8.4	None	High.
100	100	95-100	-----	0.2-0.8	0.17-0.20	7.9-8.4	None	Moderate.
55-85	50-80	25-45	20-50	0.8-2.5	0.09-0.11	5.5-6.6	None	Low.

TABLE 2.--ESTIMATED PROPERTIES

Soil series and map symbols	Depth to seasonal water table	Hydrologic group	Depth from surface (typical profile)	Classification		
				Dominant USDA texture	Unified	AASHO
	In.		In.			
Parleys: PaB, PaC, PbC, PcB.	>60	B	0-67	Silty clay loam to silt loam.	CL	A-6 or A-7
Payson: Pd, PEE-------	40-50	C	0-68	Silty clay or clay-----	CH	A-7
Peteetneet: Pf, Pg---- For Holdaway part of Pg, refer to the Holdaway series.	0-20	D	0-60	Peat and muck----------	Pt	----------
Picayune: PHG2, PJG2-- For Rake part of PJG2, refer to the Rake series.	>60		0-53	Cobbly silty clay loam to cobbly silt loam.	CL or SM	A-6 or A-4
Picayune, red variant: PlF.	>60	C	0-24	Cobbly loam and cobbly clay loam.	CL or SM	A-6 or A-4
			24	Shale.		
Pits and Dumps: PK. No valid estimates can be made.						
Pleasant Grove: PlC, PlD, PmE2, PNG2.	>60	B	0-21	Stony loam or cobbly loam.	SM	A-2
			21-60	Very cobbly loam, cobbly fine sandy loam.	GM or GC, SM or SC.	A-1 or A-2
Pleasant Vale: PnA, PoA, PoC, PpB, PrD, PsB.	>60	B	0-60	Loam to very fine sandy loam.	ML	A-4
Pleasant View: PtB----	>60	B	0-23	Fine sandy loam--------	SM	A-4
			23-60	Gravelly sandy loam and very gravelly loamy sand.	GM or SM	A-2
Preston: PuD, Pv------	(3/)	A	0-60	Fine sand--------------	SM	A-2 or A-1
Provo: Pw, Px--------- For Sunset part of Px, refer to the Sunset series.	(4/)	(5/)	0-15	Gravelly fine sandy loam.	SM	A-2, A-4
			15-50	Very gravelly sand or loamy sand.	GW, GM or GW-GM	A-1
Provo Bay: Pz, PY-----	0-60	D	0-60	Silty clay loam, loam, or silt loam.	CL or OL	A-4 or A-6
Rake: RAG2------------	>60	D	0-13	Extremely stony loam and very cobbly clay loam.	GM	A-2
			13-32	Indurated hardpan------	----------	----------
			32-37	Very stony sandy loam--	GM or GP-GM	A-2

See footnotes at end of table.

OF SOILS--Continued

Percentage passing sieve--			Percentage larger than 3 inches	Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
				In./hr.	In./in. of soil	pH		
95-100	95-100	70-95	-----	0.2-0.8	0.17-0.20	6.6-8.4	None--------	Moderate.
100	100	85-95	-----	0.05-0.2	0.09-0.11	7.9-9.0	Moderate to high.	High.
------	------	-----	-----	0.8-2.5		7.0-7.8	None--------	High.
55-85	50-80	40-70	20-50	0.8-2.5	0.10-0.14	7.3-7.8	None--------	Low.
55-85	50-80	35-65	20-50	0.2-0.8	0.11-0.13	7.4-8.4	None--------	Low.
45-55	40-50	20-30	20-40	2.5-5.0	0.06-0.10	7.4-7.9	None--------	Low.
30-60	20-45	15-25	20-50	2.5-5.0	0.04-0.08	7.4-7.9	None--------	Low.
90-100	90-100	50-65	-----	0.8-2.5	0.12-0.14	7.4-8.4	None to moderate.	Low.
90-100	90-100	40-50	-----	0.8-2.5	0.11-0.13	6.6-7.8	None--------	Low.
35-65	30-60	15-35	5-15	2.5-5.0	0.06-0.08	7.4-7.9	None--------	Low.
100	100	15-25	-----	5.0-10.0	0.02-0.05	7.4-8.4	None--------	Low.
55-85	50-80	30-40	10-20	2.5-5.0	0.05-0.07	7.4-8.4	None--------	Low.
35-45	25-35	0-15	15-25	5.0-10.0	0.02-0.04	7.4-8.4	None--------	Low.
100	100	80-90	-----	0.05-0.20	0.14-0.16	6.6-8.4	Moderate----	Moderate.
25-40	20-35	15-30	35-50	0.8-2.5	0.05-0.06	7.4-7.8	None--------	Low.
------	-----	-----	-----	<0.05	---------	-------	----------	
25-40	20-30	5-15	35-65	5.0-10.0	0.05-0.06	7.9-8.4	None--------	Low.

TABLE 2.--ESTIMATED PROPERTIES

Soil series and map symbols	Depth to seasonal water table	Hydrologic group	Depth from surface (typical profile)	Classification		
				Dominant USDA texture	Unified	AASHO
	In.		In.			
Redola:						
RdA	>60	B	0-30	Loam	ML or CL	A-4
			30-50	Very fine sandy loam	ML	A-4
ReC	>60	B	0-14	Gravelly loam	SC	A-2
			14-60	Loam	ML or CL	A-4
Riverwash: Rv. No valid estimates can be made.						
Rock land: RW. No valid estimates can be made.						
Steed:						
Se	>60	A	0-31	Very gravelly sandy loam.	GM or GP-GM	A-1
			31-60	Very gravelly loamy sand.	GW or GW-GM	A-1
Sd	>60	A	0-14	Sandy loam or light loam.	SM or ML	A-2 or A-4
			14-36	Very gravelly loamy sand.	GW or GW-GM	A-1
Sterling: SgB, SgC, SgD, SNG.	>60	A	0-21	Gravelly sandy loam	SM	A-1
			21-60	Very gravelly sand	GP-GM or GM	A-1
Sunset:						
Sr, Su, St, So	40-60	B	0-60	Loam, very fine sandy loam and silty clay loam.	ML or CL	A-4
Ss	40-60	B	0-30	Loam	ML or CL	A-4
			30-60	Gravelly loam to gravelly loamy sand.	SM or SC	A-1 or A-2
Taylorsville: TaA, TcA, TaB, TcB, TcC2.	40-60	C	0-62	Silty clay loam	CL	A-4 or A-6
Timpanogos:						
TmB, TmC	>60	B	0-48	Loam or silt loam	ML or CL	A-4
ToB	40-60	B	48-60	Gravelly, loamy coarse sand.	SM	A-2
Vineyard: VnA, VsA	30-60	(1/)	0-60	Fine sandy loam	SM	A-4
Welby: WbA, WeA, WbB, WeB, WbC, WeC, WeD2, WhD, WhE. For Hillfield part of WhE and WhD, refer to Hillfield series.	>60	B	0-65	Silt loam	ML or CL	A-4

1/ Group B in drained areas, and group C in undrained areas.

2/ Not high enough to be significant.

3/ More than 60 inches for PuD, and more than 20 inches for Pv.

OF SOILS--Continued

Percentage passing sieve--			Percentage larger than 3 inches	Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
				In./hr.	In./in. of soil	pH		
100	95-100	60-70	-----	0.8-2.5	0.15-0.17	7.4-8.4	None--------	Low.
95-100	90-100	50-70	-----	0.8-2.5	0.14-0.16	7.9-8.4	None--------	Low.
55-85	50-80	25-35	-----	2.5-5.0	0.10-0.12	7.4-8.4	None--------	Low.
95-100	80-90	60-70	-----	0.8-2.5	0.15-0.17	7.9-8.4	None--------	Low.
20-45	20-35	5-15	5-15	5.0-10.0	0.04-0.06	7.4-7.8	None--------	Low.
10-25	10-25	0-12	10-20	5.0-10.0	0.04-0.05	7.4-8.4	None--------	Low.
80-95	0-95	30-55	-----	0.8-2.5	0.10-0.12	7.4-7.8	None--------	Low.
20-40	15-30	0-10	10-20	5.0-10.0	0.04-0.05	7.4-8.4	None--------	Low.
55-65	40-50	5-20	15-20	2.5-5.0	0.06-0.08	7.9-8.4	None--------	Low.
30-40	20-30	5-15	20-30	5.0-10.0	0.04-0.05	7.9-8.4	None--------	Low.
95-100	95-100	50-70	-----	0.8-2.5	0.17-0.20	7.9-8.4	None to low.	Low.
95-100	95-100	60-70	-----	0.8-2.5	0.17-0.20	7.9-8.4	Low---------	Low.
65-95	45-55	20-30	-----	5.0-10.0	0.02-0.05	7.9-8.4	Low---------	Low.
100	100	95-100	-----	0.05-0.2	0.17-0.20	7.9-8.5	Low---------	Moderate.
100	100	65-90	-----	0.8-2.5	0.17-0.20	6.6-7.5	None--------	Low to moderate.
100	100	50-30	-----	5.0-10.0	0.02-0.05	7.9-8.4	Low---------	Low.
100	100	40-50	-----	2.5-5.0	0.10-0.14	7.9-8.4	None to moderate.	Low.
100	100	80-100	-----	0.8-2.5	0.17-0.20	7.9-8.4	Low---------	Low.

4/ 30 inches in undrained areas.

5/ Group A in drained areas, and group C in undrained areas.

Soil series and map symbols	Suitability as source of--				Soil features affecting--
	Topsoil	Sand	Gravel	Road fill	Highway location
Arave: AR----------	Poor: content of salt-alkali and silt.	Not suitable----	Not suitable----	Fair: subject to frost action.	Subject to frost action; depth to water table is 20 to 40 inches.
Beaches: BC. No interpretations; properties too variable.					
Benjamin: Bd, Be, Bf, Bg.	Poor for Bd and Bg: clayey. Not suitable for Be and Bf.	Not suitable----	Not suitable----	Poor----------	Highly plastic; unstable slopes.
Bingham: BhB, BkB, BmC, BmD.	Fair in surface layer; gravelly.	Good for concrete below a depth of 22 inches if sieved and washed.	Good for concrete if sieved.	Excellent-------	Soil features generally are favorable.
Bramwell: Br, Bs----	Poor: salt content.	Not suitable----	Not suitable----	Poor: subject to frost action.	Subject to frost action.
Chipman: Ch, Ck, Cm, Cn, Co, Cp. For McBeth part of Cp, refer to McBeth series.	Fair for all except Cm and Co which are saline; limy subsoil.	Not suitable----	Not suitable----	Poor: subject to frost action.	Subject to frost action.
Cleverly: CrD, CsB, CsC, CsD.	Poor: high gravel content.	Poor for concrete; many fines.	Poor for concrete; many fines. Good if screened.	Excellent if screened and crushed.	Soil features are generally favorable.
Cobbly alluvial land: CU.	Poor: many cobblestones.	Not suitable----	Poor for concrete; high percentage of stones larger than 3 inches and finer than No. 100 sieve.	Good----------	Subject to flooding.

Soil features affecting--Continued				Limitations for septic tank filter fields	Limitations as foundations for low buildings
Farm ponds		Agricultural drainage	Irrigation		
Reservoir areas	Embankments				
Slow permeability---	Low strength and stability.	Difficult to drain; outlets not available in some places.	Not irrigated---	Severe: depth to water table is 20 to 40 inches.	Severe: depth to water table is 20 to 40 inches.
Slow permeability; cracks when dry.	Low strength and stability.	Slow permeability subsurface drainage is difficult except in Bg.	High available water capacity; slow intake rate.	Severe: slow permeability.	Severe: high shrink-swell potential.
Rapid permeability--	Gravelly material.	Not needed-------	Low available water capacity.	Slight on 0 to 6 percent slopes. Moderate on 6 to 10 percent slopes.	Slight.
Slow permeability---	Low strength and stability.	Slow permeability; subsurface drainage is difficult.	Slow intake rate; high available water capacity; saline in some places.	Severe: slow permeability.	Severe: water table at a depth of 30 to 50 inches.
Moderately slow permeability.	Low strength and stability; Cn and Co moderately and strongly saline.	Fairly easy to drain; subsurface drainage is satisfactory.	Moderate intake rate; high available water capacity.	Severe: water table is at a depth of 20 to 60 inches.	Severe: depth to water table is 20 to 60 inches.
Rapid permeability--	Moderate strength; cobblestones and gravel.	Not needed-------	Moderate available water capacity; high intake rate.	Slight on 0 to 6 percent slopes. Moderate to severe on 6 to 15 percent slopes.	Slight.
Rapid permeability--	Cobbly or stony material.	Not used for farming.	Not irrigated--	Severe: subject to flooding.	Severe: subject to flooding.

TABLE 3.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as source of--				Soil features affecting--
	Topsoil	Sand	Gravel	Road fill	Highway location
Dagor: Da, Db-----	Excellent-------	Not suitable----	Not suitable----	Fair----------	Subject to frost action.
Dry Creek: DCF, DRG2---------	Good in surface layer; clayey subsoil.	Not suitable----	Not suitable----	Poor: subject to frost action; moderate shrink-swell potential.	Subject to frost action; moderate shrink-swell potential.
DEF---------- Dry Creek, stony subsoil variant.	Not suitable----	Not suitable----	Not suitable----	Fair: subject to frost action.	Subject to frost action.
Gappmayer: GAG----	Not suitable----	Not suitable----	Not suitable----	Good at a depth of more than 4 feet.	Slope----------
Henefer: HEG, HFF, HFG2, HKG. For McPhie part of HFF and HFG2, refer to McPhie series. For Rake part of HKG, refer to Rake series.	Good in surface layer; cobbly to very cobbly and clayey in subsoil.	Not suitable----	Not suitable----	Poor: subject to frost action; moderate shrink-swell potential.	Subject to frost action; moderate shrink-swell potential.
Hillfield: HmE, HmF, HNG, HOF, HpF. For Layton part of HNG refer to Layton series. For Sterling part of HOF, refer to Sterling series. For Welby part of HpF, refer to Welby series.	Fair: high silt content.	Not suitable----	Not suitable----	Fair: subject to frost action.	Subject to frost action.

Soil features affecting--Continued				Limitations for septic tank filter fields	Limitations as foundations for low buildings
Farm ponds		Agricultural drainage	Irrigation		
Reservoir areas	Embankments				
Moderate permeability.	Slow permeability if compacted; stable slopes.	Not needed------	High available water capacity; moderately rapid intake rate.	Moderate: moderate permeability.	Moderate: moderate bearing strength.
Slow permeability; cracks when dry.	Moderate shrink-swell potential.	Not needed------	Not irrigated--	Severe: slow permeability.	Moderate: moderate shrink-swell potential.
Moderate permeability.	Very cobbly or stony.	Not needed------	Not irrigated--	Severe: moderate permeability; 6 to 30 percent slopes.	Slight.
Rapid permeability; slope.	Moderate strength; cobblestones and gravel.	Not used for farming.	Not irrigated; slope.	Severe: slope--	Severe: slope.
Slow permeability; cracks when dry.	Low strength and stability.	Not needed------	Not irrigated--	Severe: slow permeability.	Severe: slope.
Moderate permeability.	Low strength and stability.	Not needed------	Slope; low intake rate.	Severe: slope--	Moderate on 10 to 15 percent slopes. Severe on 15 to 60 percent slopes.

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TABLE 3.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as source of--				Soil features affecting--
	Topsoil	Sand	Gravel	Road fill	Highway location
Holdaway: Hr	Good: limy subsoil; hardpan.	Not suitable	Not suitable	Fair: subject to frost action.	Subject to frost action.
Hs	Not suitable; content of salt and alkali.	Not suitable	Not suitable	Poor: subject to frost action.	Subject to frost action.
Ironton: Ir, Is	Good for Ir. Poor for Is which is moderately saline-alkali.	Not suitable	Not suitable	Fair: subject to frost action.	Subject to frost action.
Jordan: Jo	Not suitable; salt and alkali content.	Not suitable	Not suitable	Poor: very high salt content; very high shrink-swell potential	Very high salt content; high shrink-swell potential; depth to water table is 30 to 60 inches.
Keigley: KeA, KeB, KgA.	Fair	Not suitable	Not suitable	Fair: subject to frost action.	Subject to frost action.
Kidman: KmA, KmB, KmC.	Good	Not suitable	Not suitable	Fair: subject to frost action.	Subject to frost action.
Kilburn: KNG2, KOD, KRE2.	Poor: gravelly and stony material.	Poor for concrete; large amounts of fines and stones.	Poor for concrete; large amounts of fines and stones.	Excellent	No unfavorable features.

OF SOILS--Continued

Soil features affecting--Continued				Limitations for septic tank filter fields	Limitations as foundations for low buildings
Farm ponds		Agricultural drainage	Irrigation		
Reservoir areas	Embankments				
Moderately slow permeability above hardpan; hardpan is between a depth of 20 and 40 inches.	Low strength and stability; moderate organic-matter content.	Fairly easy to drain; subsurface drainage is satisfactory; outlets are not available in some places.	Moderate intake rate; high available water capacity above the hardpan.	Severe: depth to water table is 30 to 40 inches.	Severe: depth to water table is 30 to 40 inches.
Very slow permeability in hardpan, and moderately slow above hardpan.	Very high salt content.	Not used for farming.	Not irrigated----	Severe: depth to water table is 30 to 40 inches.	Severe: depth to water table is 30 to 40 inches.
Moderate permeability.	Low strength and stability.	Fairly easy to drain; subsurface drainage is satisfactory.	Moderate intake rate; high available water capacity.	Severe: depth to water table is 30 to 60 inches.	Severe: depth to water table is 30 to 60 inches.
Very slow permeability.	Very high salt and alkali content.	Drainage is difficult.	Not irrigated; requires reclamation.	Severe: very slow permeability.	Severe: high shrink-swell potential.
Moderately slow permeability.	Low strength and stability.	Not needed------	Moderate intake rate; high available water capacity.	Severe: moderately slow permeability.	Moderate: moderate shrink-swell potential.
Moderate permeability.	Moderate strength.	Not needed------	Rapid intake rate; fair available water capacity.	Moderate: moderate permeability.	Moderate: moderate bearing strength.
Rapid permeability.	Stony and gravelly material.	Not needed------	Moderate available water capacity; high intake rate.	Moderate on 3 to 10 percent slopes. Severe on 15 to 50 percent slopes.	Moderate on 3 to 10 percent slopes. Severe on 15 to 50 percent slopes.

TABLE 3.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as source of--				Soil features affecting--
	Topsoil	Sand	Gravel	Road fill	Highway location
Kirkham: Ks, Kt, Ku.	Fair: fine-textured material; not suitable for Kt and Ku which are moderately strongly and strongly saline-alkali.	Not suitable-----	Not suitable-----	Poor: subject to frost action.	Subject to frost action; water table.
Lakewin: LaC, LaD, LcE.	Poor: gravelly and cobbly material.	Good for concrete below a depth of 20 inches if screened.	Good for concrete below a depth of 20 inches if screened.	Excellent------	No unfavorable features.
Layton: LeD, LfC, LmA, LnB.	Fair: sandy material.	Not suitable-----	Not suitable-----	Good below a depth of 14 inches.	High water table in some areas.
Logan: Lo---------	Fair: high water table.	Not suitable-----	Not suitable-----	Not suitable----	High water table.
Logan, heavy variant: Ls.	High silt and clay content.	Not suitable-----	Not suitable-----	Fair: subject to frost action.	Subject to frost action.
Manila: MAF-------	Good in surface layer; clayey subsoil.	Not suitable-----	Not suitable-----	Poor: subject to frost action; high shrink-swell potential.	Subject to frost action; high shrink-swell potential.
Martini: Mf-------	Good----------	Not suitable-----	Not suitable-----	Good----------	Depth to water table is 40 to 60 inches.

OF SOILS--Continued

Soil features affecting--Continued				Limitations for septic tank filter fields	Limitations as foundations for low buildings
Farm ponds		Agricultural drainage	Irrigation		
Reservoir areas	Embankments				
Moderately slow permeability.	Low strength and stability.	Difficult to drain; suitable outlets are limited.	Slow intake rate; low available water capacity.	Severe: moderately slow permeability.	Moderate: moderate strink-swell potential.
Rapid permeability.	Gravelly and cobbly material.	Not needed-------	Rapid intake rate; low available water capacity.	Slight on 1 to 6 percent slopes. Moderate on 6 to 10 percent slopes. Severe on 10 to 30 percent slopes.	Slight on 1 to 8 percent slopes. Moderate on 8 to 15 percent slopes. Severe on 15 to 30 percent slopes.
Rapid permeability.	Not suitable; sandy material.	Easily drained if needed.	Rapid intake rate; low available water capacity.	Slight on 0 to 6 percent slopes. Moderate on 6 to 10 percent slopes. Severe on 10 to 15 percent slopes.	Slight on 0 to 8 percent slopes. Moderate on slopes of 8 to 15 percent
High organic-matter content; slow permeability.	Not suitable--	Difficult to drain; lack of outlets.	Not needed unless drained.	Severe: depth to water table is 12 to 40 inches.	Severe: depth to water table is 12 to 40 inches.
Slow permeability.	Low strength and stability.	Difficult to drain; slow permeability; lack of outlets.	Slow intake rate; high available water capacity.	Severe: depth to water table is 20 to 40 inches.	Severe: depth to water table is 20 to 40 inches.
Slow permeability; subject to cracking when dry.	High shrink-swell potential.	Not needed-------	Not irrigated----	Severe: slow permeability.	Severe: high shrink-swell potential.
Rapid permeability.	Not suitable; fine sand and silt.	Easily drained---	Rapid intake rate; moderate available water capacity.	Moderate: depth to water table is 40 to 60 inches.	Moderate: depth to water table is 40 to 60 inches.

TABLE 3.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as source of--				Soil features affecting--
	Topsoil	Sand	Gravel	Road fill	Highway location
McBeth: Mh, Mn------	Excellent for Mh. Moderate for Mn; moderately saline.	Not suitable-----	Not suitable----	Fair: subject to frost action.	Subject to frost action; water table.
McMurdie: MrC, MtE2. For Taylorsville part of MtE2, refer to Taylorsville series.	Good in surface layer; clayey subsoil.	Not suitable-----	Not suitable----	Poor: depth to clay layers is limited.	Very plastic----
McPhie---------- (Mapped only with Henefer soils.)	Good in surface layer; cobbly material in subsoil.	Not suitable-----	Not suitable----	Good, except in surface layer.	Slope----------
Mixed alluvial land: MU, MX. No interpretations; properties too variable.					
Parleys: PaB, PaC, PbC, PcB.	Good in surface layer; clayey in subsoil.	Not suitable-----	Not suitable----	Fair: subject to frost action.	Subject to frost action.
Payson: Pd, PEE-----	Fair in surface layer; subsoil is saline or alkali.	Not suitable-----	Not suitable----	Fair: subject to frost action; high salt content.	Water table; high to very high salt content.
Peteetneet: Pf, Pg, No interpretations for Peteetneet soils; needs onsite investigation. For Holdaway part of Pg, refer to Holdaway series.					

OF SOILS--Continued

Soil features affecting--Continued				Limitations for septic tank filter fields	Limitations as foundations for low buildings
Farm ponds		Agricultural drainage	Irrigation		
Moderately rapid permeability.	Low strength and stability.	Easily drained----	Rapid intake rate; high available water capacity.	Severe: depth to water table is 20 to 50 inches.	Severe: depth to water table is 20 to 50 inches.
Moderately slow permeability; cracks when dry.	Unstable in fills; subject to severe cracking.	Not needed--------	High available water capacity; moderately rapid intake rate.	Severe: moderately slow permeability.	Severe: high shrink-swell potential.
Moderate permeability.	High strength and stability.	Not needed--------	Not irrigated---	Moderate on 5 to 10 percent slopes. Severe on 15 to 60 percent slopes.	Moderate on 5 to 15 percent slopes. Severe on 15 to 60 percent slopes.
Moderately slow permeability	Low strength and stability.	Not needed--------	Moderate intake rate; high available water capacity.	Severe: moderately slow permeability.	Moderate: moderate shrink-swell potential.
Slow permeability.	High shrink-swell potential.	Subsurface drainage is difficult.	Slow intake rate; high available water capacity.	Severe: slow permeability.	Severe: high shrink-swell potential.

TABLE 3.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as source of--				Soil features affecting--
	Topsoil	Sand	Gravel	Road fill	Highway location
Picayune: PHG2, PJG2. For Rake part of PJG2, refer to Rake series.	Poor: cobbly material.	Not suitable----	Not suitable----	Fair: subject to frost action.	Subject to frost action; slope.
PIF----------	Poor: cobbly material.	Not suitable----	Not suitable----	Fair: subject to frost action.	Subject to frost action; slope.
Pits and Dumps: PK. No interpretations.					
Pleasant Grove: PlC, PkD, PmE2, PNG2.	Poor: gravelly and stony material.	Not suitable----	Good for concrete if crushed and screened.	Excellent------	Slope----------
Pleasant Vale: PoA, PoC, PnA, PpB, PrD, PsB.	Good----------	Not suitable----	Not suitable----	Fair: subject to frost action.	Subject to frost action.
Pleasant View: PtB--	Good in uppermost 2 feet; gravelly material below a depth of 2 feet.	Poor for concrete; many fines.	Poor for concrete; many fines.	Excellent below a depth of 2 feet.	No unfavorable features.
Preston: PuD--------	Not suitable; fine sand.	Poor for concrete because of gradation.	Not suitable----	Excellent------	No unfavorable features.
Preston, high water table variant: Pv.	Not suitable; coarse material.	Poor for concrete;no gradation and needs to be screened.	Not suitable----	Good----------	High water table.
Provo: Pw, Px------- For Sunset part of Px, refer to Sunset series.	Poor: gravelly material.	Good for concrete below a depth of 20 inches if screened.	Good for concrete below a depth of 20 inches if screened.	Excellent below a depth of 20 inches.	Depth to water table is less than 30 inches.

OF SOILS--Continued

Soil features affecting--Continued				Limitations for septic tank filter fields	Limitations as foundations for low buildings
Farm ponds		Agricultural drainage	Irrigation		
Reservoir areas	Embankments				
Moderate permeability.	Cobbly and stony material.	Not needed-------	Not irrigated---	Severe: slope---	Severe: slope----
Slope----------	Low strength and stability.	Not needed-------	Not irrigated---	Severe: slope---	Severe: slope---
Moderately rapid permeability.	High strength and stability in uppermost 4 feet.	Not needed-------	Rapid intake rate.	Slight on 3 to 6 percent slopes. Moderate on 6 to 10 percent slopes. Severe on 10 to 60 percent slopes.	Slight on 3 to 6 percent slopes. Moderate on 6 to 15 percent slopes. Severe on 15 to 60 percent slopes.
Moderate permeability.	Moderate strength and stability.	Easily drained if drainage is needed.	Moderate intake rate.	Slight on 1 to 6 percent slopes. Moderate on 6 to 10 percent slopes.	Moderate: moderate bearing strength.
Moderately rapid permeability.	Moderate strength for core; good for shell below a depth of 2 feet.	Not needed-------	Moderate available water capacity; high intake rate.	Slight----------	Slight.
Rapid permeability.	Not suitable; fine sand.	Not needed-------	Very rapid intake rate; low available water capacity.	Slight on 0 to 6 percent slopes. Moderate on 6 to 10 percent slopes.	Slight on 0 to 5 percent slopes. Moderate on 5 to 10 percent slopes.
Rapid permeability.	Not suitable; mostly fine sand.	Easily drained---	Not irrigated---	Severe: depth to water table is less than 20 inches.	Severe: depth to water table is less than 20 inches.
Rapid permeability.	Good core in uppermost 20 inches; good shell below a depth of 20 inches.	Easily drained---	Rapid intake rate; low available water capacity.	Severe: depth to water table is less than 30 inches.	Severe: depth to water table is less than 30 inches.

TABLE 3.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as source of--				Soil features affecting--
	Topsoil	Sand	Gravel	Road fill	Highway location
Provo Bay: PY, Pz---	Excellent for PY. Poor for Pz.	Not suitable-----	Not suitable----	Fair: subject to frost action.	Subject to frost action; water table.
Rake: RAG2----------	Not suitable; stony; slopes.	Not suitable-----	Not suitable----	Fair: shallow--	Slope----------
Redola: RdA, ReC----	Good in RdA. Poor for ReC.	Not suitable-----	Not suitable----	Fair: subject to frost action.	Subject to frost action.
Riverwash: RV. No interpretations; properties too variable.					
Rock land: RW. No interpretations. Land is 50 to 80 percent rock outcrops.					
Steed: Sd, Se-------	Poor: gravelly material.	Good for concrete if screened.	Good for concrete if screened.	Excellent------	No unfavorable features.
Sterling: SgB, SgC, SgD, SNG.	Poor: gravelly material.	Good for concrete if screened.	Good for concrete if screened.	Excellent------	No unfavorable features.
Sunset: Sr, Ss, So, St, Su.	Good for all except for Su which is poor because it is moderately saline.	Not suitable----	Not suitable----	Fair: subject to frost action.	Subject to frost action; water table.
Taylorsville: TaA, TaB, TcA, TcB, TcC2.	High content of silt and clay.	Not suitable----	Not suitable----	Fair: subject to frost action.	Subject to frost action.
Timpanogos: TmB, TmC, ToB.	Good----------	Not suitable----	Not suitable----	Fair: subject to frost action.	Subject to frost action.

OF SOILS--Continued

Soil features affecting--Continued				Limitations for septic tank filter fields	Limitations as foundations for low buildings
Farm ponds		Agricultural drainage	Irrigation		
Reservoir areas	Embankments				
High organic-matter content.	Low strength and stability.	Drainage is difficult; no outlets.	Rapid intake rate; high available water capacity.	Severe: depth to water table is 0 to 60 inches.	Severe: depth to water table is 0 to 60 inches.
Slope; hardpan-----	Shallow to hardpan.	Not needed------	Not irrigated---	Severe: slope---	Severe: slope.
Moderate permeability.	Moderate strength and stability.	Not needed------	Rapid intake rate; high available water capacity.	Moderate: moderate permeability.	Moderate: moderate bearing strength.
Rapid permeability.	Gravelly material.	Not needed------	Rapid intake rate; low available water capacity.	Slight----------	Slight.
Rapid permeability.	Gravelly material below a depth of 20 inches.	Not needed------	Rapid intake rate; low available water capacity.	Slight----------	Slight.
Moderate permeability.	Moderate strength and stability.	Easily drained--	Moderate to rapid intake rate; high available water capacity.	Moderate: moderate permeability; depth to water table is 40 to 60 inches.	Moderate: depth to water table is 40 to 60 inches.
Slow permeability.	Low strength and stability.	Not needed------	Slow intake rate; high available water capacity.	Severe: slow permeability.	Moderate: moderate shrink-swell potential.
Moderate permeability.	Moderate strength and stability.	Not needed for TmB and TmC, needed for ToB, which is easily drained.	Moderate intake rate; high available water capacity.	Moderate: moderate permeability.	Moderate: moderate shrink-swell potential.

TABLE 3.--ENGINEERING INTERPRETATIONS

Soil series and map symbols	Suitability as source of--				Soil features affecting--
	Topsoil	Sand	Gravel	Road fill	Highway location
Vineyard: VnA, VsA.	Fair: good in reclaimed areas.	Not suitable----	Not suitable----	Fair: subject to frost action.	Subject to frost action.
Welby: WbA, WbC, WbB, WeA, WeB, WeC, WeD2, WhD, WhE. For Hillfield part of WhD and WhE, refer to Hillfield series.	Fair: high silt content.	Not suitable----	Not suitable----	Fair: subject to frost action.	Subject to frost action.

OF SOILS--Continued

Soil features affecting--Continued				Limitations for septic tank filter fields	Limitations as foundations for low buildings
Farm ponds		Agricultural drainage	Irrigation		
Reservoir areas	Embankments				
Moderately rapid permeability.	Moderate strength and stability.	Easily drained and reclaimed.	Rapid intake rate; moderate available water capacity.	Moderate to severe: depth to water table is 30 to 60 inches.	Moderate to severe: depth to water table is 30 to 60 inches.
Moderate permeability.	Low strength and stability.	Not needed------	Rapid intake rate; high available water capacity.	Moderate: moderate permeability.	Moderate: moderate bearing strength.

TABLE 4.--ENGINEERING

[Tests performed by the Bureau of Public Roads (BPR) and the State Road Commission of Utah, in

Soil and location	Depth	Coarse fraction greater than 3 inches	Mechanical analysis 1/					
			Percentage passing sieve--					
			3-inch	2-inch	1½-inch	1-inch	3/4-inch	No. 4 (4.7 mm.)
	Inches	Pct.						
Benjamin silty clay:								
NE¼ sec. 8, T. 8 S.,	0-25	----	----	----	----	----	----	----
R. 2 E.	31-49	----	----	----	----	----	----	----
Bingham gravelly loam:								
SE¼ sec. 3, T. 6 S.,	0-8	----	----	100	99	91	85	70
R. 2 E.	14-22	----	100	95	91	78	73	59
	42-65	20	80	72	61	53	47	29
Chipman silty clay loam:								
SW¼ sec. 30, T. 5 S.,	0-10	----	----	----	----	----	----	----
R. 2 E.	12-23	----	----	----	----	----	----	----
	34-56	----	----	----	----	----	----	----
Hillfield silt loam:								
NW¼ sec. 30, T. 4 S.,	3-45	----	----	----	----	----	----	----
R. 2 E.								
Jordan silt loam:								
SE¼ sec. 6, T. 6 S.,	0-7	----	----	----	----	----	----	----
R. 2 E.	7-15	----	----	----	----	----	----	----
	23-55	----	----	----	----	----	----	----
Keigley silty clay loam:								
NW¼ sec. 31, T. 9 S.,	0-65	----	----	----	----	----	----	----
R. 2 E.								
Kirkham silty clay loam:								
SE¼ sec. 20, T. 7 S.,	0-36	----						100
R. 3 E.								
Layton fine sandy loam:								
NE¼ sec. 4, T. 6 S.,	0-14	----						
R. 2 E.	26-57	----						
Manila silt loam:								
SE¼ sec. 18, T. 9 S.,	0-6	----						
R. 3 E.	17-42	----						
	42-63	----	----	100	95	91	88	83
McMurdie silt loam:								
NE¼ sec. 34, T. 5 S.,	0-11	----						
R. 2 E.	11-25							
	25-47							
	47-63							
Parleys loam:								
NE¼ sec. 26, T. 4 S.,	0-7	----	----	----	----	----	100	99
R. 1 E.	7-20							
	20-35							
	35-67							

See footnotes at end of table

TEST DATA

accordance with standard procedures of the American Association of State Highway Officials (AASHO) (1)]

Mechanical analysis 1/--Continued							Liquid limit	Plasticity index	Classification	
Percentage passing sieve--Continued			Percentage smaller than--2/							
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO	Unified 3/
							Pct.			
----	100	95	93	85	67	48	50	24	A-7-6(16)	ML-CL
----	100	95	92	85	65	48	46	23	A-7-6(14)	CL
67	60	41	37	26	13	8	26	8	A-4(1)	SC
56	50	31	28	19	12	9	24	9	A-2-4(0)	SC
24	18	7	6	4	2	1	4/NP	NP	A-1-a(0)	GW-GM
100	99	88	85	70	45	31	44	11	A-7-5(9)	ML
100	99	91	86	70	50	37	40	15	A-6(10)	ML-CL
100	99	79	72	48	24	17	24	5	A-4(8)	ML-CL
100	98	59	47	28	16	11	20	1	A-4(5)	ML
----	100	67	62	43	20	10	15	2	A-4(6)	ML
----	100	77	76	71	58	44	46	27	A-7-6(16)	CL
----	100	99	98	91	62	45	42	21	A-7-6(13)	CL
100	99	96					36	15	A-6(10)	CL
99	98	79					38	12	A-6(9)	ML-CL
100	98	38	31	24	15	11	NP	NP	A-4(1)	SM
100	98	18	13	9	5	4	NP	NP	A-2-4(0)	SM
100	99	89	80	54	31	24	27	7	A-4(8)	ML-CL
100	99	93	87	68	49	43	49	26	A-7-6(16)	CL
82	80	70	63	46	32	28	42	23	A-7-6(14)	CL
	100	98	92	62	34	21	24	6	A-4(8)	ML-CL
	100	98	95	83	62	50	47	23	A-7-6(15)	CL
	100	99	97	43	62	48	51	24	A-7-6(16)	MH-CH
100	99	98	96	81	55	39	40	17	A-6(11)	CL
98	94	74	66	45	26	19	30	10	A-4(8)	CL
100	97	82	75	54	35	29	37	16	A-6(10)	CL
100	99	93	87	68	45	34	43	20	A-7-6(13)	CL
100	99	85	79	56	37	28	34	14	A-6(10)	CL

Soil and location	Depth	Coarse fraction greater than 3 inches	Mechanical analysis 1/					
			Percentage passing sieve--					
			3-inch	2-inch	1½-inch	1-inch	3/4-inch	No. 4 (4.7 mm.)
	Inches	Pct.						
Preston fine sand:								
SE¼ sec. 34, T. 6 S., R. 2 E.	0-72							
Steed gravelly sandy loam:								
SW¼ sec. 12, T. 5 S., R. 1 E.	0-31	5	----	95	89	78	68	40
	31-60	10	90	81	73	59	52	34
Steed sandy loam:								
NW¼ sec. 14, T. 5 S., R. 1 E.	0-14	----	----	100	99	97	96	92
	14-36	----	100	97	91	79	70	39
Sterling gravelly fine sandy loam:								
SE¼ sec. 31, T. 9 S., R. 2 E.	0-60	----	100	66	59	52	48	28
Sunset loam:								
NW¼ sec. 14, T. 5 S., R. 1 E.	0-14	----	----	----	----	----	100	99
	14-34	----	----	----	----	----		
Taylorsville silty clay loam:								
SE¼ sec. 36, T. 4 S., R. 1 E.	0-13	----	----	----	----	----		
	13-27	----	----	----	----	----		
	27-62	----	----	----	----	----		
Timpanogos loam:								
NW¼ sec. 3, T. 5 S., R. 1 E.	0-9	----	----	----	----	----		
	9-18	----	----	----	----	----		
	18-30	----	----	----	----	----		
	30-48	----	----	----	----	----		
Welby silt loam:								
NE¼ sec. 12, T. 5 S., R. 1 W.	7-22	----	----	----	----	----		
	22-54	----	----	----	----	----		
	54-65							

1/ Mechanical analysis according to AASHO Designation: T 88-57 (1). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

TEST DATA--Continued

Mechanical analysis 1/--Continued							Liquid limit	Plasticity index	Classification	
Percentage passing sieve--Continued			Percentage smaller than--2/						AASHO	Unified 3/
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
							Pct.			
100	94	20	----	----	----	----	17	4/ NP	A-2-4(0)	SM
28	16	8	8	5	3	2	18	2	A-1-a(0)	GP-GM
29	22	12	10	5	3	2	20	2	A-1-a(0)	GM
91	86	54	46	31	17	11	23	4	A-4(4)	ML-CL
28	16	5	4	3	2	1	NP	NP	A-1-a(0)	GW-GM
24	18	12					24	3	A-1-a	GP-GM
97	88	62	55	39	23	18	30	9	A-4(5)	ML-CL
100	90	52	44	29	15	10	25	5	A-4(3)	ML-CL
	100	96	92	72	43	29	28	8	A-4(8)	CL
	100	99	97	82	55	38	33	12	A-6(9)	CL
		100	98	78	38	27	31	10	A-4(8)	ML-CL
100	98	88	84	66	43	29	32	11	A-6(8)	CL
100	98	83	79	62	43	32	27	9	A-4(8)	CL
100	96	78	71	52	32	22	27	7	A-4(8)	ML-CL
100	97	68	57	32	16	10	20	2	A-4(7)	ML
	100	3	72	40	21	14	24	4	A-4(8)	ML-CL
	100	7	92	52	22	14	25	3	A-4(8)	ML
	100	9	97	70	25	16	29	5	A-4(8)	ML-CL

2/ Based on total material; laboratory test data were corrected for amount discarded in sampling.

3/ SCS and BPR have agreed to consider that all soils having plasticity indexes within two points of the A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are ML-CL and GW-GM.

4/ Nonplastic.

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DESCRIPTIONS OF THE SOILS

This section describes the soil series and mapping units of Utah County: Central Part. The approximate acreage and proportionate extent of each mapping unit are given in table 5.

The procedure in this section is first to describe each soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read both the description of that unit and the description of the soil series to which it belongs.

Each soil series contains two descriptions of a soil profile. The first is brief and in terms familiar to a layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Riverwash, for example, does not belong to a series but, nevertheless, is listed in alphabetic order along with the soil series.

This survey area was mapped according to the intensity of use. Most of it is irrigated farmland and was mapped at high intensity, but a large part was mapped at low intensity. The intensity of the mapping for the units described in the following pages is indicated by the soil symbol in parentheses after the name of each mapping unit. This symbol also identifies the mapping unit on the detailed soil map. If the second letter of a symbol is a small letter, the unit was mapped at high intensity. A symbol having the second letter a capital represents low intensity mapping. The composition of units mapped at low intensity is more variable than that of units mapped at high intensity, but composition has been controlled well enough to allow interpretations for expected uses.

Listed at the end of each description of a mapping unit is the capability unit in which the mapping unit has been placed. The page on which each capability unit is described can be found by referring to the "Guide to Mapping Units" at the back of this survey.

Many of the terms used in describing soils can be found in the Glossary at the back of this survey and in the "Soil Survey Manual" (12).

TABLE 5.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Soil	Area	Extent
	Acres	Percent
Arave silt loam	1,125	0.5
Beaches	705	.3
Benjamin silty clay	3,910	1.9
Benjamin silty clay, moderately alkali	2,823	1.4
Benjamin silty clay, sandy substratum	1,561	.8
Benjamin silty clay, strongly alkali	1,188	.6
Binghas loam, 1 to 3 percent slopes	3, 611	1.7
Bingham gravelly loam, 1 to 3 percent slopes	8, 533	4.1
Bingham cobbly loam, 3 to 6 percent slopes	652	.3
Bingham cobbly loam, 6 to 10 percent slopes	545	.3
Bramwell silty clay loam	2,386	1.2
Bramwell silty clay loam, drained	2,548	1.2
Chipman loam	454	.2
Chipman silty clay loam	4,746	2.3
Chipman silty clay loam, moderately deep water table	2,566	1.2
Chipman silty clay loam, moderately saline	1,637	.8
Chipman silty clay loam, strongly saline	698	.3
Chipman-McBeth complex	992	.5
Cleverly cobbly sandy loam, 6 to 15 percent slopes	1,952	.9
Cleverly gravelly fine sandy loam, 1 to 3 percent slopes	216	.1
Cleverly gravelly fine sandy loam, 3 to 6 percent slopes	1,091	.6
Cleverly gravelly fine sandy loam, 6 to 15 percent slopes	1,102	.5
Cobbly alluvial land	983	.5
Dagor loam	575	.3
Dagor silt loam	254	.1
Dry Creek cobbly loam, 10 to 30 percent slopes	1,926	.9
Dry Creek extremely stony loam, stony subsoil variant, 6 to 30 percent slopes	499	.2
Dry Creek cobbly loam, thin surface variant, 30 to 60 percent slopes, eroded	1,845	.9

TABLE 5.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Soil	Area	Extent
	Acres	Percent
Gappmayer cobbly loam, 50 to 70 percent slopes	1,402	0.7
Henefer loam, 35 to 70 percent slopes	399	.2
Henefer-McPhie association, 5 to 30 percent slopes	2,312	1.1
Henefer-McPhie association, 30 to 60 percent slopes, eroded	2,743	1.3
Henefer-Rake association, 35 to 70 percent slopes	2,353	1.1
Hillfield silt loam, 10 to 20 percent slopes	594	.3
Hillfield silt loam, 20 to 30 percent slopes	248	.1
Hillfield-Layton complex, 30 to 60 percent slopes	622	.3
Hillfield-Sterling complex, 20 to 35 percent slopes	1,192	.6
Hillfield-Welby silt loams, 6 to 35 percent slopes	888	.4
Holdaway silt loam	3,414	1.7
Holdaway silt loam, strongly saline-alkali	802	.4
Ironton loam	338	.2
Ironton loam, moderately saline-alkali	482	.2
Jordan silt loam	434	.2
Keigley silty clay loam, 0 to 1 percent slopes	1,008	.5
Keigley silty clay loam, 1 to 3 percent slopes	357	.2
Keigley silty clay loam, extended season, 0 to 2 percent slopes	777	.4
Kidman very fine sandy loam, 0 to 1 percent slopes	800	.4
Kidman very fine sandy loam, 1 to 3 percent slopes	1,738	.8
Kidman very fine sandy loam, 3 to 6 percent slopes	813	.4
Kilburn gravelly fine sandy loam, 15 to 30 percent slopes, eroded	623	.3
Kilburn stony sandy loam, 3 to 15 percent slopes	671	.3
Kilburn very gravelly sandy loam, 30 to 50 percent slopes, eroded	1,976	1.0
Kirkham silty clay loam	4,086	2.0
Kirkham silty clay loam, moderately saline-alkali	1,189	.6
Kirkham silty clay loam, strongly saline-alkali	680	.3
Lakewin cobbly fine sandy loam, 15 to 30 percent slopes	605	.3
Lakewin gravelly fine sandy loam, 1 to 6 percent slopes	3,201	1.6
Lakewin gravelly fine sandy loam, 6 to 15 percent slopes	668	.3
Layton fine sandy loam, 1 to 6 percent slopes	1,484	.7
Layton fine sandy loam, slowly permeable substratum, 0 to 1 percent slopes	352	.2
Layton fine sandy loam, water table, 1 to 3 percent slopes	1,195	.6
Layton loamy fine sand, 6 to 15 percent slopes	481	.2
Logan silty clay loam	1,257	.6
Logan silty clay loam, heavy variant	1,302	.6
Manila silt loam, 10 to 30 percent slopes	1,293	.6
Martini fine sandy loam	587	.3
McBeth silt loam	4,429	2.1
McBeth silt loam, moderately saline	481	.2
McMurdie silt loam, 3 to 6 percent slopes	203	.1
McMurdie-Taylorsville complex, 6 to 20 percent slopes, eroded	414	.2
Mixed alluvial land	3,632	1.8
Mixed alluvial land, saline	1,211	.6
Parleys gravelly loam, overwashed, 3 to 6 percent slopes	220	.1
Parleys loam, 0 to 3 percent slopes	3,070	1.5
Parleys loam, 3 to 6 percent slopes	1,046	.5
Parleys silty clay loam, 0 to 3 percent slopes	1,878	.9
Payson silty clay loam	828	.4
Payson-Terrace escarpments complex, 1 to 20 percent slopes	1,166	.6

TABLE 5.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Soil	Area	Extent
	Acres	Percent
Peteetneet peat	1,262	0.6
Peteetneet-Holdaway complex	523	.3
Picayune cobbly loam, red variant, 30 to 60 percent slopes	945	.5
Picayune cobbly silt loam, 35 to 70 percent slopes, eroded	1,236	.6
Picayune-Rake association, 35 to 70 percent slopes, eroded	602	.3
Pits and Dumps	1,708	.8
Pleasant Grove gravelly loam, 3 to 6 percent slopes	1,933	.9
Pleasant Grove gravelly loam, 6 to 10 percent slopes	2,081	1.0
Pleasant Grove stony loam, 10 to 25 percent slopes, eroded	4,552	2.2
Pleasant Grove-Terrace escarpments complex, 30 to 60 percent slopes, eroded	2,503	1.2
Pleasant Vale gravelly loam, extended season, 1 to 3 percent slopes	607	.3
Pleasant Vale gravelly sandy loam, extended season, 6 to 10 percent slopes	534	.3
Pleasant Vale loam, 0 to 2 percent slopes	2,251	1.1
Pleasant Vale loam, extended season, 0 to 2 percent slopes	957	.5
Pleasant Vale loam, extended season, 3 to 6 percent slopes	409	.2
Pleasant Vale silty clay loam, 1 to 3 percent slopes	593	.3
Pleasant View fine sandy loam, 1 to 3 percent slopes	988	.5
Preston fine sand, 1 to 10 percent slopes	773	.4
Preston loamy fine sand, high water table variant	285	.1
Provo gravelly fine sandy loam	677	.3
Provo-Sunset complex	1,301	.6
Provo Bay peaty silt loam	358	.2
Provo Bay silty clay loam	2,628	1.3
Rake extremely stony loam, 20 to 70 percent slopes, eroded	2,650	1.3
Redola gravelly loam, 3 to 6 percent slopes	643	.3
Redola loam, 0 to 3 percent slopes	1,711	.8
Riverwash	557	.3
Rock land	3,745	1.8
Steed gravelly sandy loam	2,925	1.4
Steed sandy loam	899	.4
Sterling gravelly fine sandy loam, 1 to 3 percent slopes	1,187	.6
Sterling gravelly fine sandy loam, 3 to 6 percent slopes	709	.3
Sterling gravelly fine sandy loam, 6 to 10 percent slopes	1,040	.5
Sterling-Terrace escarpments complex, 30 to 70 percent slopes	1,432	.7
Sunset loam	6,423	3.1
Sunset loam, clay substratum	725	.3
Sunset loam, gravelly substratum	1,162	.6
Sunset loam, moderately saline	741	.4
Sunset loamy fine sand	209	.1
Taylorsville silty clay loam, 0 to 1 percent slopes	2,480	1.2
Taylorsville silty clay loam, 1 to 3 percent slopes	3,660	1.8
Taylorsville silty clay loam, extended season, 0 to 1 percent slopes	472	.2
Taylorsville silty clay loam, extended season, 1 to 3 percent slopes	944	.5
Taylorsville silty clay loam, extended season, 3 to 6 percent slopes, eroded	1,443	.7
Timpanogos loam, 0 to 3 percent slopes	4,466	2.2
Timpanogos loam, 3 to 6 percent slopes	644	.3
Timpanogos loam, water table, 0 to 3 percent slopes	605	.3

TABLE 5.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Soil	Area	Extent
Vineyard fine sandy loam, 0 to 2 percent slopes	2,609	1.3
Vineyard fine sandy loam, moderately saline, 0 to 2 percent slopes	1,229	.6
Welby silt loam, 0 to 1 percent slopes	1,239	.6
Welby silt loam, 1 to 3 percent slopes	2,522	1.2
Welby silt loam, 3 to 6 percent slopes	473	.2
Welby silt loam, extended season, 0 to 1 percent slopes	601	.3
Welby silt loam, extended season, 1 to 3 percent slopes	1,608	.8
Welby silt loam, extended season, 3 to 6 percent slopes	1,337	.6
Welby silt loam, extended season, 6 to 10 percent slopes, eroded	750	.4
Welby-Hillfield silt loams, 6 to 10 percent slopes	1,181	.6
Welby-Hillfield silt loams, 10 to 30 percent slopes	605	.3
City-Urban	2,200	1.1
Industrial area	2,170	1.0
Pond or water surface	1,735	.8
Total	206,504	100.0

Arave Series

The Arave series consists of deep, poorly drained, calcareous, saline-alkali, nearly level soils. These soils are on low lake terraces, mainly south of Lincoln Beach and north of the Lehi pumping station. They formed in calcareous lake sediments of mixed origin.

Arave soils are at elevations of 4,480 to 4,500 feet. The average annual precipitation ranges from 10 to 12 inches. The soils are usually moist. The mean annual soil temperature ranges between 47° and 52° F. The frost-free period is 130 to 150 days.

In a typical profile, the surface layer is dark grayish-brown, moderately alkaline silt loam about 5 inches thick. The subsoil is grayish-brown, strongly alkaline, strongly saline, firm silty clay loam about 8 inches thick. The substratum is strongly calcareous, grayish-brown and dark brownish-gray, strongly saline, strongly alkaline silty clay loam and silt loam. Mottles occur at some depth between 15 and 28 inches.

The vegetation is dominantly greasewood, saltgrass, and samphire.

Arave soils are not extensive in this survey area. They are used only for livestock pasture and wildlife habitat.

Representative profile of Arave silt loam in a range area 2 miles south of Lincoln Beach, section 13, T. 8 S., R. 1 E.:

A11--0 to 2 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, platy structure; slightly hard, very friable, slightly sticky, and plastic; common very fine and few fine roots; many very fine, vesicular pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.2); abrupt, smooth boundary.

A12--2 to 5 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (2.5Y 4/2) when moist; strong, fine, platy structure; slightly hard, very friable, slightly sticky, and plastic; common very fine and few fine roots; few very fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.2); strongly saline; abrupt, smooth boundary.

B2tca--5 to 9 inches, light-gray (10YR 7/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; weak, medium, prismatic structure that parts readily to strong, fine or very fine, angular blocky; hard, firm, sticky, and plastic; common very fine roots; few very fine pores; common thin clay films on ped faces; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.6); strongly saline; clear, wavy boundary.

B3ca--9 to 13 inches, light-gray (10YR 7/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; weak, medium, prismatic structure; hard, firm, sticky, and plastic; few very fine roots; common fine and very fine pores; few thin clay films on ped faces; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.6); strongly saline; gradual, smooth boundary.

C1ca--13 to 28 inches, light-gray (10YR 7/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, firm, sticky,

and plastic; few very fine and fine roots; common very fine and few fine pores; strongly calcareous; strongly alkaline (pH 8.6); strongly saline; abrupt, smooth boundary.

A11b--28 to 32 inches, light brownish-gray (10YR 6/2) silt loam, dark brownish gray (10YR 4/2) when moist; common, medium, distinct, light olive-brown (2.5Y 5/4) mottles when moist; massive; hard, very friable, sticky, and plastic; few very fine roots; common very fine and few fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.4); strongly saline; gradual, smooth boundary.

A12b--32 to 42 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; few very fine roots; common very fine pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.6); strongly saline; abrupt, smooth boundary.

C2--42 to 60 inches, light-gray (10YR 7/2) loamy very fine sand, grayish brown (10YR 5/2) when moist; common, medium, distinct, light olive-brown (2.5Y 5/4) mottles when moist; massive; slightly hard, very friable, nonsticky, and nonplastic; few very fine roots; common very fine pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.6); strongly saline.

The A horizon ranges from dark grayish brown to dark brown, and it is 3 to 8 inches thick. Its structure ranges from thin to medium platy and from weak to strong. The B2 horizon is silty clay loam that contains 27 to 35 percent clay and more than 15 percent fine or coarser sand. Its color ranges from dark grayish brown to grayish brown or from dark gray to gray. The structure of the B horizon is weak to moderate prismatic. The exchangeable sodium percentage ranges from 25 to 75. The B horizon ranges from 7 to 14 inches in thickness. The C horizon ranges from silty clay loam to loamy very fine sand. Color in the C horizon ranges from dark grayish brown to light grayish brown or brown to pale brown.

Arave silt loam (0 to 1 percent slopes) (AR).--A profile of this soil is the one described as typical of the series. Below a depth of 3 to 5 inches, this soil is very strongly saline in places.

This soil is poorly drained and slowly permeable. Roots penetrate only to a depth of about 40 inches. The water table is 20 to 40 inches from the surface. The soil holds 10 inches of water, but only about 2 inches is available to plants because of the strong salt content. Runoff is slow. The erosion hazard is none to slight.

Included with this soil in mapping are small areas of similar soils that are not so strongly saline-alkali.

This soil is used mainly for range. The strong salt and alkali content makes it unsuitable for cultivation. Plantings of tall wheatgrass are successful in places where irrigation water can be applied to start the grass. A few fields have been planted to alfalfa, but yields are low. Drainage and reclamation are costly and difficult. In most places, drainage is not economical because outlets are lacking and the soil is slowly permeable. Capability unit VIIw-285, nonirrigated.

Beaches

Beaches (BC) is a miscellaneous land type along the shores of Utah Lake. Generally it forms a ridge 3 to 8 feet high that parallels the shoreline. In places, however, the ridge is hardly visible. This land type is composed mainly of sandy and silty sediments. In places it contains some fine gravel and fresh-water snail shells.

This land supports little vegetation, although there are some willows, cottonwoods, and annual and perennial weeds in places.

This land provides habitat for wildlife, and can be used as a source of sand and gravel, but it has no farming value. Capability unit VIIIw-2, nonirrigated.

Benjamin Series

The Benjamin series consists of deep, somewhat poorly drained, strongly calcareous, nearly level soils. They are on the Spanish Fork River flood plain, where they formed in fine-textured alluvium derived mainly from weathered limestone and shale.

Elevations range from 4,500 to 4,600 feet. The average annual precipitation is 14 to 16 inches, and the frost-free period is 130 to 150 days. These soils are not continuously dry in all parts between depths of 7 and 20 inches for as long as 60 consecutive days, but they are dry for 90 cumulative days in some parts between these depths. The mean annual soil temperature is 49° or 50° F.

In a typical profile, the surface layer is very dark grayish-brown, calcareous, very firm silty clay about 17 inches thick. The next layer is dark-gray, mottled, calcareous, very firm silty clay about 20 inches thick. Below this is stratified, calcareous clay to sandy loam.

The native vegetation is dominantly saltgrass and greasewood.

The Benjamin soils are used mainly for small grain, corn, alfalfa, and pasture. The strongly saline-alkali soils are used for range pasture.

Representative profile of Benjamin silty clay in a cultivated field 1 1/2 miles north of the town of Lake Shore, about 650 feet west of the Lake Shore-Benjamin road:

Ap1--0 to 1 inch, grayish-brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) when moist; moderate, very fine, granular structure; hard, very firm, sticky, and plastic; few very fine roots; strongly calcareous;

lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.

Ap2--1 to 4 inches, grayish-brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) when moist; moderate, fine and very fine, angular, blocky structure; very hard, very firm, sticky and very plastic; common fine and very fine roots; few fine and very fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.2); clear, smooth boundary. Cracks 3/8 to 1 inch wide exist in this horizon, but they do not extend below it.

A1--4 to 17 inches, grayish-brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure that parts to moderate, medium, angular blocky; very hard, very firm, sticky, and very plastic; common very fine roots; common very fine and few fine pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.

C1--17 to 25 inches, gray (10YR 6/2) silty clay, dark gray (10YR 4/1) when moist; variegated moist colors include grayish brown (2.5Y 5/2), brown (7.5YR 5/4), and very dark gray (10YR 2/1); massive; very hard, very firm, sticky, and very plastic; few very fine roots; common very fine pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.

C2g--25 to 38 inches, gray (10YR 6/1) silty clay, dark gray (10YR 4/1) when moist; few, fine, distinct, dark-brown (7.5YR 4/4) mottles; variegated moist colors include reddish brown (5YR 4/3) and brown (10YR 5/3); massive, very hard, very firm, sticky, and very plastic; few very fine roots; few very fine pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.

C3--38 to 46 inches, pink (7.5YR 7/3) heavy silty clay loam, dark brown (7.5YR 4/3) when moist; common, medium, prominent, yellowish-brown (10YR 5/3) and yellowish-red (5YR 4/6) mottles; massive; hard, firm, slightly sticky, and plastic; no observable roots or pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.4); clear, smooth boundary.

C4--46 to 52 inches, light-brown (7.5YR 6/3) silty clay, dark brown (7.5YR 4/3) when moist; common, medium, prominent, yellowish-brown (10YR 5/6) mottles; variegated moist colors include yellowish red (5YR 4/6); massive; very hard, very firm, sticky, and very plastic; no observable roots or pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.

IIC5--52 to 60 inches, light-brown (7.5YR 6/3) sandy loam, dark brown (7.5YR 4/3) when moist; few, medium, prominent, yellowish-brown (10YR 5/6) mottles; massive; soft, very friable, nonsticky, and nonplastic; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.0).

The A horizon is very dark grayish brown, dark grayish brown, or dark brown, and it ranges from 12 to 20 inches in thickness. It is calcareous, firm or very firm silty clay. The upper C horizon is dark gray if not mottled. If mottled, it may be very dark grayish brown, dark grayish brown, or grayish brown. The texture is silty clay or clay. The lower C horizon is stratified clay to sandy loam. It has a dark-brown, reddish-brown, or dark yellowish-brown color.

The lime content ranges from 15 to 30 percent throughout the profile. Salinity is slight to strong, and reaction ranges from moderately to strongly alkaline. The organic-matter content is more than 0.5 percent to a depth of 50 inches below the surface.

Benjamin silty clay (0 to 3 percent slopes) (Bd).--A profile of this soil is the one described as typical of the series. Stratification below a depth of 30 inches is common in some places, and texture can range from loam to clay but generally ranges from clay loam to clay.

Included in mapping are small areas of Kirkham silty clay loam and of Pleasant Vale loam. Small, strongly saline-alkali spots also are included. East of Spring Lake about 160 acres of very dark gray, noncalcareous soil is included. This acreage is poorly drained and is used mainly for pasture.

This soil is somewhat poorly drained and is slowly permeable. Depth of root penetration is restricted by the water table and poor aeration. The water table fluctuates but typically is between depths of 30 and 50 inches unless the surface is drained. Drainage systems have been installed successfully in many places. This soil is nonsaline to slightly saline. It holds about 11 inches of water available to plants. Runoff is slow, and there is no erosion hazard. The natural fertility is medium. This soil is difficult to work and can be cultivated satisfactorily only within a narrow range of moisture content.

This soil is used to grow alfalfa, small grains, corn, pasture, and sugar beets. Capability unit IIIw-25, irrigated.

Benjamin silty clay, moderately alkali (0 to 1 percent slopes) (Be).--This soil is moderately alkali and moderately saline, otherwise its profile is similar to that described as typical for the series. Some strongly saline-alkali spots are included. Reclamation is difficult and slow because water permeates slowly.

This soil is somewhat poorly drained. It holds about 11 inches of water to a depth of 5 feet, but the salt content reduces the amount of water available to plants to about 8 inches. The water table fluctuates between depths of 30 and 60 inches. Root penetration is restricted to a depth of about 30 inches by the water table and poor aeration.

This soil is used mainly for pasture. Sugar beets, alfalfa, and barley also are grown, but they are not well suited unless the soil has been drained and reclaimed. When drained and reclaimed, this soil is suited to irrigated pasture, grass-legume hay, corn, and small grain crops. Capability unit VIIw-285, nonirrigated.

Benjamin silty clay, sandy substratum (0 to 1 percent slopes) (Bg).--This soil has a profile similar to that described as typical for the series, but 30 to 60 inches below the surface it has sandy layers 1 foot or more thick. These layers enhance the possibilities of drainage where outlets are available.

Included with this soil in mapping are small areas that are strongly saline-alkali.

This soil is somewhat poorly drained and is nonsaline to slightly saline. Permeability of the substratum below a depth of about 38 inches is moderately rapid. The water table fluctuates at depths of 30 to 60 inches from the surface unless the soil is drained. About 10 inches of available water is held by this soil to a depth of 5 feet.

Irrigated crops of alfalfa, pasture, small grain, corn, and sugar beets are grown on this soil. Capability unit IIIw-25, irrigated.

Benjamin silty clay, strongly alkali (0 to 1 percent slopes) (Bf).--This soil occurs on the outer edges and lower parts of the Spanish Fork River flood plain, and it is associated with very strongly saline soils. Its profile is similar to that described as typical for the series, except it is strongly alkali and strongly saline. Salt crusts on the surface are common. In some places, the surface layer is very dark gray, which indicates development under conditions of poor drainage and a dense plant cover.

This soil is not suitable for crop production unless reclaimed. Natural fertility is low. Drainage and reclamation are difficult because of the slow permeability and lack of drainage outlets. Because of high salt content, this soil holds less than 2 inches of water available to plants. The vegetation is a sparse growth of greasewood, saltgrass, and other salt-tolerant plants.

This soil is used for range pasture. Seedings of tall wheatgrass are possible in areas where irrigation water is available for starting the grass. Capability unit VIIw-285, nonirrigated.

Bingham Series

The Bingham series consists of well-drained gravelly soils on terraces and alluvial fans, mainly on the Highland, Orem, and Mapleton Benches. Slopes range from 0 to 10 percent. The soils formed in gravelly, medium-textured and coarse-textured mixed alluvium.

Elevations range from 4,700 to 5,200 feet. The average annual precipitation is 14 to 18 inches. The soils are usually moist but are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature ranges from 47° to 54° F. The frost-free period is 150 to 170 days.

In a typical profile, the surface layer is very dark grayish-brown, neutral, gravelly loam about 6 inches thick. The subsoil is dark-brown, neutral, hard gravelly sandy clay loam or gravelly heavy fine sandy loam about 12 inches thick. The substratum is brown, calcareous, loose, very gravelly sand. Organic matter makes up 2 to 4 percent of the surface soil and decreases regularly to less than 0.5 percent at some depth less than 50 inches below the surface.

The vegetation consists of bunchgrass and big sagebrush.

The Bingham soils are moderately extensive in this survey area. They are planted mainly to orchards (pl. I, bottom) and other irrigated crops.

Representative profile of Bingham gravelly loam, 1 to 3 percent slopes, in a cultivated field about 3/4 mile east and 1/2 mile north of the junction of U. S. Highway No. 91 and State Road 52 in Orem, at a point 2,500 feet east and 500 feet south of the NW. corner of section 11, T. 6 S., R. 2 E.:

Ap--0 to 6 inches, dark grayish-brown (10YR 4/2) gravelly light loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to moderate, fine, granular; slightly hard, friable, slightly sticky, and plastic; many fine roots; common fine pores; neutral (pH 7.3); clear, smooth boundary.

B21t--6 to 12 inches, brown (10YR 4/3) gravelly sandy clay loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure that parts to moderate, fine, granular; hard, firm, sticky, and plastic; common medium and fine roots; few fine pores; thin patchy clay films, neutral (pH 7.0); gradual, wavy boundary.

B22t--12 to 18 inches, brown (7.5YR 4/3) gravelly heavy fine sandy loam, dark brown (7.5YR 3/3) when moist; moderate, medium and fine, subangular blocky structure; very hard, firm, sticky, and plastic; few fine roots; common medium and fine pores; thin patchy clay films; neutral (pH 7.1); gradual, wavy boundary.

IIIB3ca--18 to 27 inches, brown (7.5YR 4/3) very gravelly sandy loam, dark brown (7.5YR 3/3) when moist; massive; soft, friable, slightly sticky, and slightly plastic; few fine roots; few interstitial pores; thin, occasional clay films; lime coating on gravel; mildly alkaline (pH 7.5); gradual, wavy boundary.

IICca--27 to 40 inches, dark-brown (10YR 6/3) very gravelly sand, brown (10YR 4/3) when moist; single grain; loose; nonsticky and nonplastic; few fine roots; interstitial pores; strongly calcareous; lime is disseminated and also appears as coatings on gravel; moderately alkaline (pH 8.2).

The A horizon ranges from dark brown to very dark brown. It has loam, gravelly loam, or cobbly loam texture. The B horizon is dark-brown, very dark brown, or very dark grayish-brown gravelly or cobbly sandy clay loam to heavy fine sandy loam. The lower part of the B horizon has visible lime coatings on the gravel or a calcareous matrix. The B horizon is 10 to 30 inches thick. Its reaction is neutral to mildly alkaline. The C horizon is grayish-brown, brown, or pale-brown very gravelly or very cobbly sandy loam to sand. Lime content in the matrix ranges from 10 to 40 percent.

Bingham cobbly loam, 3 to 6 percent slopes (BmC).--This soil is on alluvial fans. It has a cobbly surface layer, but its profile is otherwise similar to that described as typical for the series.

This soil is well drained and rapidly permeable. It holds about 3.5 inches of available water to a depth of 5 feet. Runoff is medium, and the erosion hazard is moderate.

This soil occurs mainly south of the town of Salem. It is used to grow dryland alfalfa and pasture. Where irrigation water is available, orchards and alfalfa are grown. Capability units IVs-14, irrigated, and IVe-UX, nonirrigated.

Bingham cobbly loam, 6 to 10 percent slopes (BmD).--This soil has a profile similar to that described as typical for the series, except the surface layer is cobbly. In places there is a weakly cemented lime hardpan.

This soil has rapid permeability. It holds about 3 inches of available water to a depth of 5 feet. Runoff is rapid, and the erosion hazard is severe.

Dryland alfalfa and pasture are the principal crops. Where irrigation water is available, it is used for alfalfa and apple or peach orchards. Capability unit IVs-14, irrigated, and IVe-UX, nonirrigated.

Bingham gravelly loam, 1 to 3 percent slopes (BkB).--A profile of this soil is the one described as typical of the series (pl. II, top left). The surface layer ranges from 6 to 10 inches in thickness, and in places the coarse fragments are of cobble size. In places, particularly on the bench east of Spanish Fork city, the surface layer and subsoil are slightly calcareous because they have been recharged with lime from the irrigation water. In some places on the Highland Bench, the gravel is moderately cemented in the substratum. On the high bench south of the "Point of the Mountain", on the east side of the valley, this soil has only a thin coating of lime on the gravel below a depth of 40 inches.

Included with this soil in mapping are small areas of a Cleverly gravelly sandy loam.

This soil is well drained and rapidly permeable. Rooting depth is limited by large amounts of gravel. This soil can hold 3 to 3.5 inches of available water in the upper 5 feet. Runoff is slow, and the erosion hazard is slight. The natural fertility is moderate.

This soil is well suited to peach, cherry, apple, and pear orchards and to small grain, alfalfa, corn, and pasture. Capability unit IVs-14, irrigated.

Bingham loam, 1 to 3 percent slopes (BhB).--This soil has a profile similar to that described as typical for the series, but the first 10 inches is less than 20 percent gravel.

Included with this soil in mapping are small areas of gravelly loamy fine sand and some small areas of Bingham gravelly loam. South of the Payson high school there also is an area of about 200 acres that has a calcareous, silty clay loam surface soil. A small area north of Lehi has clean sand, with no gravel, below a depth of about 30 inches.

This soil is well drained and rapidly permeable. It holds about 4 inches of available water to a depth of 5 feet. Runoff is slow, and the erosion hazard is slight. The natural fertility is moderate.

This soil is well suited to apple, peach, pear, cherry, and apricot orchards, to small fruits, and to alfalfa, small grains, and pasture. Capability unit IIIs-14, irrigated.

Bramwell Series

The Bramwell series consists of deep, somewhat poorly drained nearly level or gently sloping soils. These soils are on low terraces, mainly near Lehi. They formed in mixed, silty, calcareous lake sediments. They are moderately to strongly alkaline, and moderately saline, and have a water table within 30 to 50 inches of the surface unless they have been drained and reclaimed.

Elevations range from 4,490 to 4,600 feet. The average annual precipitation is 12 to 16 inches. The mean annual soil temperature is 49° or 50° F., and the frost-free period is 130 to 150 days.

In a typical profile, the surface layer is dark grayish-brown, calcareous silty clay loam about 11 inches thick. The next layer is similar to the surface layer and about 9 inches thick. Below a depth of about 20 inches is grayish-brown, strongly calcareous, firm silty clay loam. Distinct strong-brown mottles occur at a depth of less than 40 inches.

Bramwell soils are used to grow irrigated crops and pasture.

Representative profile of Bramwell silty clay loam in a pasture about 2 miles northwest of Lehi city, at a point 2,000 feet west and 1,400 feet north of the SE. corner of section 6, T. 5 S., R. 1 E.:

Ap--0 to 6 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, platy structure; very hard, firm, slightly sticky, and plastic; common fine and few medium roots; few fine pores; moderately calcareous; lime

is disseminated; moderately alkaline (pH 8.0); strongly saline; clear, smooth boundary.

A1--6 to 11 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; very hard, firm, slightly sticky, and plastic; common fine and few medium roots; common fine and few medium pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.3); moderately saline; clear, smooth boundary.

C1--11 to 20 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium and fine, angular blocky structure; hard, firm, slightly sticky, and plastic; common fine roots; common fine pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.2); slightly saline; clear, smooth boundary.

C2ca--20 to 31 inches, light-gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) when moist; few, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium and fine, angular blocky structure; hard, firm, slightly sticky, and plastic; few fine roots; common fine pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.5); moderately saline; gradual, smooth boundary.

C3ca--31 to 60 inches, light brownish-gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 4/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; very hard, firm, slightly sticky, and plastic; strongly calcareous; lime is disseminated and in nodules; moderately alkaline (pH 8.0).

The A horizon is dark grayish-brown to brown silty clay loam to loam or silt loam 3 to 12 inches thick. The C horizon is grayish-brown or dark grayish-brown silty clay loam or clay loam with 27 to 35 percent clay and less than 15 percent fine or coarser sand. The lime content ranges from 30 to 46 percent.

The C2ca and C3ca horizons are similar to the C1 horizon in color but are stratified in most places and range from fine sandy loam to silty clay. The lime content ranges from 20 to 35 percent. Salinity of the soil profile ranges from slight to strong.

Bramwell silty clay loam (Br).--A profile of this soil is described as typical of the series. A thin salt crust occurs in places. Texture of the surface layer ranges from heavy silt loam to silty clay loam. The substrata are commonly clayey, laminated lake sediments. The water table fluctuates 30 to 50 inches below the surface. It is highest in the spring and early in summer.

Included with this soil in mapping are small areas of Taylorsville silty clay loam and Chipman silty clay loam, as well as strongly saline areas and unnamed soils that have a hardpan. West of Lehi city near Dry Creek is a rough undulating area that has 10 to 28 inches of sandy overwash. South and east of Geneva Steel plant is an area of windblown loamy fine sand 10 to 20 inches thick. The area is nearly level and is used as cropland, but the hazard of wind erosion is moderate. Northeast of the town of Salem in a depressional area is a small acreage of a soil that is underlain by gravel at a depth of 20 to 36 inches and has a water table 16 to 36 inches from the surface. The water is at the surface in the lowest parts of the depression

This soil is slowly permeable, somewhat poorly drained, and moderately saline. It can hold about 9 inches of available water to the depth of 5 feet. Fertility is moderate. Runoff is slow, and there is no erosion hazard.

Most of this soil is in native pasture. If drained, the soil is suited to the production of alfalfa, barley, and improved pasture. Capability unit IIIw-27, irrigated.

Bramwell silty clay loam, drained (Bs).--This soil has a profile similar to that described as typical for the series, except it is only slightly saline-alkali.

Included with this soil in mapping are small areas of Taylorsville silty clay loam and, near American Fork city, small acreages that have not been drained and reclaimed. Near the Geneva Steel plant, the surface layer is loam or light loam 10 to 15 inches thick.

Most of the areas have been improved by drains or removal of excess water. The soil can hold about 12 inches of available water in the upper 5 feet. In places, there are clayey layers that are very slowly permeable below a depth of 30 inches. These layers limit effective drainage and reclamation. Natural fertility of this soil is moderate.

This soil is used to grow improved pasture, alfalfa, corn, sugar beets, and small grains. Most of it is cultivated and irrigated. Capability unit IIIw-25, irrigated.

Chipman Series

The Chipman series consists of deep, poorly drained, strongly calcareous, nearly level soils. These soils are on low lake terraces, few of which are more than 15 feet above the present high water level of Utah Lake. The largest acreages are south and west of Pleasant Grove city and south of American Fork city. These soils formed in lake-laid sediments of mixed origin but are dominantly from shale and limestone.

The Chipman soils are at elevations of 4,490 to 4,575 feet. The average annual precipitation ranges from 12 to 16 inches. The soils are usually moist. Depth to the water table ranges between 20 and 60 inches unless the soils are drained. The mean annual soil temperature is 49° or 50° F. Mean summer temperatures range from 65° to 75° F. The frost-free period is 130 to 150 days.

In a typical profile, the surface layer is very dark-gray, calcareous silty clay loam about 16 inches thick. Below this layer is dark grayish-brown or dark-gray, strongly calcareous loam to silty clay loam. Distinct mottles occur within 20 inches of the surface.

The native vegetation is mainly wet meadow grasses, wiregrass, and sedges.

The Chipman soils are used for irrigated crops and pasture.

Representative profile of Chipman silty clay loam in a cultivated field about one-half mile south of the Lehi sugar factory, at a point 1,500 feet south and 100 feet west of the NW. corner of section 21, T. 5 S., R. 1 E.:

Apca--0 to 8 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) when moist; moderate, medium and fine, granular structure; slightly hard, friable, slightly sticky, and plastic; few large, few medium, and common fine roots; common, fine and very fine, discontinuous pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.8); clear, smooth boundary.

A1g--8 to 16 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) when moist; common, medium and distinct, dark yellowish-brown (10YR 4/4) mottles; weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; hard, firm, slightly sticky, and plastic; few medium roots, common fine and very fine roots; few large pores, common medium and fine pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.8); clear, smooth boundary.

C1cag--16 to 20 inches, gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) when moist; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; hard, firm, slightly sticky and plastic; few large, few medium, and common fine roots; common medium pores and many fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.9); clear, smooth boundary.

C2ca--20 to 27 inches, light-gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) when moist; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; hard, firm, slightly sticky, and plastic; few medium and fine roots and common very fine roots; common medium pores and many fine pores; very strongly calcareous; lime is disseminated and in soft nodules; mildly alkaline (pH 7.8); clear, smooth boundary.

C3ca--27 to 44 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; few, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; slightly hard, friable, slightly sticky, and slightly plastic; few medium and fine roots; common fine and many very fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.9); abrupt, smooth boundary.

C4cag--44 to 60 inches, gray (10YR 5/1) clay loam, dark gray (10YR 4/1) when moist; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; hard, firm, sticky, and plastic; few fine roots; common fine and many very fine pores; strongly calcareous; contains soft lime nodules; moderately alkaline (pH 8.0).

The A horizon is dark gray or very dark gray if not mottled. If mottles occur at a depth of less than 20 inches, colors in the A horizon range to grayish brown or dark grayish brown. The texture in the A horizon is silty clay loam. The Cca horizons range from dark gray to grayish brown or dark grayish brown. Texture in the Cca horizon is silty clay loam or clay loam; less than 35 percent of the material is clay, and less than 15 percent is coarser than very fine sand. Lime content ranges from 30 to 60 percent. At depths below 30 inches, hues of 5Y or 5GY occur in places. At depths of more than 40 inches, colors are similar to those in the upper part of the C horizon, but texture ranges from silty clay loam to loamy sand. Chipman soils are nonsaline to strongly saline and nonalkaline to strongly alkaline.

Chipman loam (0 to 1 percent slopes) (Ch).--This soil has a profile like that described as typical of the series, except it has a loam or sandy loam surface layer 8 to 15 inches thick.

Included with this soil in mapping is a small area near Beer Creek north of Payson where the overwash is 20 to 40 inches deep.

Chipman loam is poorly drained, and permeability is moderately slow. The depth to the water table ranges from 30 to 60 inches and is largely controlled by drains. This soil can hold about 12 inches of available water. Runoff is slow, and the erosion hazard is none to slight.

The surface layer is lower in organic-matter content and in natural fertility than other Chipman soils.

This soil is used to grow corn, small grain, sugar beets, alfalfa, and pasture. Capability unit IIw-2, irrigated.

Chipman silty clay loam (0 to 1 percent slopes) (Ck).--A profile of this soil is the one described as typical of the series. Depth to the extremely calcareous layers varies; these layers range from a few inches to about 3 feet in thickness. In places the lime nodules form a weak hardpan. In the area below Vineyard Road layers of peat as much as 10 inches thick are below a depth of 3 feet.

Included with this soil in mapping are areas of Ironton loam, McBeth silt loam, and Bramwell silty clay loam. West of the town of Spring Lake, on the bottom land, the surface layer is dark gray.

This Chipman soil is poorly drained. Depth to the water table ranges from 30 to 60 inches and is controlled by drains. Permeability is moderately slow. Roots penetrate to the water table. The soil holds about 12 inches of available water. Runoff is slow, and there is no erosion hazard. Natural fertility is very high, and the soil is easy to work.

This soil is well suited to corn, small grains, sugar beets, alfalfa, pasture, and vegetables. Capability unit IIw-2, irrigated.

Chipman silty clay loam, moderately deep water table (0 to 1 percent slopes) (Cm).--This soil has a profile similar to that described as typical for the series, except depth to the water table is 20 to 30 inches. This Chipman soil occurs at lower elevations than Chipman silty clay loam, which has the profile described as typical for the series.

Included with this soil in mapping, near Utah Lake and Provo Bay, are areas that are subject to flooding and ponding.

This soil is poorly drained. Permeability is moderately slow. Runoff is slow, and the erosion hazard is none to slight.

This soil is used for wet pasture and is not suited to cultivated crops unless it is drained. Capability unit IVw-25, irrigated.

Chipman silty clay loam, moderately saline (0 to 1 percent slopes) (Cn).--This soil is moderately saline and moderately alkali, otherwise its profile is similar to that described as typical for the series.

Included with this soil in mapping, east of the Provo Airport, are some very strongly alkali and saline spots 2 to 5 acres in size.

This soil is poorly drained. Depth to the water table is usually 20 to 30 inches. The salt content reduces the amount of water available to plants to about 8 inches. Permeability is moderately slow.

This soil is used for wet pasture. Crops are limited to those that are salt tolerant. If the soil is drained and leached of salt and alkali, it is capable of producing alfalfa, barley, sugar beets, and improved pasture. Capability unit IIIw-27, irrigated.

Chipman silty clay loam, strongly saline (0 to 1 percent slopes) (Co).--The profile of this soil is similar to that described as typical for the series, except the surface layer is strongly saline and strongly alkali. The content of salt and alkali decreases in the substratum. This soil occupies areas south of Lincoln Beach that are just a few feet higher than Utah Lake.

This soil is poorly drained. Permeability is moderately slow. Depth to the water table is mainly 20 to 30 inches. Runoff is slow, and the erosion hazard is none to slight. Because of the high salt content, only about 3 inches of water is available to plants.

This soil is used for wet pasture and is not suitable for cultivation unless it is drained and leached of salt and alkali. Drainage is not generally practical because there are no available outlets. Capability unit VIIw-285, nonirrigated.

Chipman-McBeth complex (Cp).--These soils occur on undulating, low, lake terraces, mainly southeast of American Fork city. About 60 percent of the complex is Chipman silty clay loam that has a moderately deep water table, and 40 percent is McBeth silt loam that is moderately saline. A profile of a McBeth silt loam is described as typical for the McBeth series. The McBeth soil is on broad ridges that are 4 or 5 feet higher than the depressions in which the Chipman soil occurs.

The vegetation is meadow grasses, annual weeds, and sedges.

Areas near Utah Lake are subject to flooding during years of high water. These soils are used for pasture. Capability unit IVw-25, irrigated.

Cleverly Series

The Cleverly series consists of deep, well-drained, gravelly soils on alluvial fans and colluvial slopes along the south foothills of the Traverse Mountains. Slopes range from 1 to 15 percent. These soils formed in alluvium and colluvium derived from weathered quartzite and sandstone.

Elevations range from 4,650 to 5,600 feet. The average annual precipitation is 14 to 20 inches. These soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 48° to 52° F., and the frost-free period is 150 to 170 days.

In a typical profile, the surface layer is very dark grayish-brown, neutral, gravelly fine sandy loam and light loam about 16 inches thick. The subsoil is dark brown, firm, neutral, gravelly light loam about 26 inches thick. The substratum is yellowish-brown, neutral, gravelly sandy loam.

The native vegetation is big sagebrush, bunchgrasses, cheatgrass, and scattered clumps of brushy Gambel oak.

The Cleverly soils are used for irrigated crops and orchards, dryland crops, and range.

Representative profile of Cleverly gravelly fine sandy loam, 6 to 15 percent slopes, in a nonirrigated wheat field 2 miles north of Lehi city, at a point 2,400 feet west and 1,200 feet north of the SE. corner of section 29, T. 4 S., R. 1 E.:

Ap--0 to 7 inches, dark grayish-brown (10YR 4/2) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky, and slightly plastic; common fine roots and few medium roots; common fine pores; neutral (pH 6.9); clear, smooth boundary.

A1--7 to 16 inches, dark grayish-brown (10YR 4/2) gravelly light loam, very dark grayish brown

(10YR 3/2) when moist; weak, fine, subangular blocky structure that parts to weak, fine, granular; hard, firm, slightly sticky, and plastic; few fine roots; common fine pores; neutral (pH 6.8); clear, smooth boundary.

B21--16 to 29 inches, dark grayish-brown (10YR 4/3) gravelly light loam, dark brown (10YR 3/3) when moist; moderate, medium and fine, subangular blocky structure; hard, firm, sticky, and plastic; few fine roots; common fine pores; neutral (pH 6.9); clear, wavy boundary.

B3--29 to 42 inches, brown (10YR 4/3) gravelly light loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; hard, firm, sticky, and plastic; few very fine roots; common fine pores; neutral (pH 7.2); clear, wavy boundary.

Cca--42 to 56 inches, pale-brown (10YR 6/3) gravelly sandy loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard, friable, nonsticky, and nonplastic; no roots; few fine interstitial pores; some lime coating on the gravel; neutral (pH 7.3).

The A horizon ranges from 10 to 20 inches in thickness and from very dark grayish brown to dark brown or very dark brown in color. The texture is gravelly fine sandy loam, cobbly fine sandy loam, light loam, or sandy loam. The B horizon is dark brown, dark grayish brown, brown, or dark yellowish brown. It is 15 to 30 inches thick, and its texture is similar to that of the surface layer. The C horizon is yellowish brown to olive brown or light olive brown; below a depth of 40 inches is gravelly or very gravelly sandy loam to sand that is 25 to 60 percent gravel, cobblestones, or stones. The organic-matter content decreases regularly with depth; at a depth of 50 inches it is less than 0.5 percent. Lime content ranges from thin lime coatings on coarse fragments to a slightly calcareous matrix. Reaction ranges from neutral to mildly alkaline.

Cleverly cobbly sandy loam, 6 to 15 percent slopes (CrD).--The profile of this soil is similar to that described as typical of the series, except the surface layer is cobbly sandy loam. The substratum, below a depth of about 40 inches, is typically gravelly or cobbly sandy loam, but it is gravelly or cobbly sand in places.

Included with this soil in mapping are small areas of soils having slopes of 3 to 6 percent.

This soil is well drained and is rapidly permeable. Roots generally grow deep, but they may be restricted by gravel and cobblestones in places. The soil holds about 4 inches of available water in the upper 5 feet. Runoff is medium, and the erosion hazard is severe. Some small gullies have formed on the steeper slopes.

Because of the cobblestones, this soil is difficult to cultivate. It is used for range, for cherry, peach, or apple orchards, and for alfalfa or pasture. Capability units IVs-14, irrigated, and IVe-UX, nonirrigated.

Cleverly gravelly fine sandy loam, 1 to 3 percent slopes (CsB).--The profile of this soil is similar to that described as typical for the series, except that it generally has less gravel. This soil occupies the lower parts of the alluvial fans. Lake sediments are within 5 feet of the surface in most places.

This soil is well drained and rapidly permeable. It can hold about 3.5 inches of available water in the upper 5 feet. Surface runoff is slow, and the erosion hazard is slight.

This soil is used for irrigated cherry, peach, pear, and apple orchards, and for growing small grains, pasture, and alfalfa. Capability units IIIs-14, irrigated, and IVe-UX, nonirrigated.

Cleverly gravelly fine sandy loam, 3 to 6 percent slopes (CsC).--The profile of this soil is similar to that described as typical for the series.

This soil is well drained and rapidly permeable. Runoff is slow. The available water is about 4 inches in the upper 5 feet. The erosion hazard is moderate.

This soil is used for irrigated and dryland alfalfa, pasture, and small grains. It is also used for irrigated cherry, apple, and peach orchards. Capability units IIIs-14, irrigated, and IVe-UX, nonirrigated.

Cleverly gravelly fine sandy loam, 6 to 15 percent slopes (CsD).--The profile of this soil is the one described as typical of the series. The gravel in the surface layer ranges from 20 to 50 percent, in volume, and is mostly 0.5 to 3 inches in diameter. In a few places, however, the gravel is pea size or smaller. In some places, there are a few boulders of limestone and quartzite that have rolled down from the slopes above.

Included with this soil in mapping are small areas of Kilburn soils that have a very gravelly light sandy loam subsoil and lack blocky structure.

This Cleverly soil is well drained and rapidly permeable. Roots penetrate deep. The soil holds about 6 inches of available water in the upper 5 feet. Runoff is medium. Under irrigation, the erosion hazard is severe. The natural fertility is moderate.

This soil is used for growing dryland wheat, alfalfa, and pasture. Peach, apple, and cherry orchards and alfalfa are grown under irrigation. Capability units IIIe-14, irrigated, and IVe-UX, nonirrigated.

Cobbly Alluvial Land

Cobbly alluvial land (CU) occurs on flood plains, generally close to the present stream channel. It is a mixture of soil material, cobblestones, and rock fragments that have accumulated during floods. Colluvium, from terrace escarpments, also has accumulated in some places. Slopes are generally between 1 and 3 percent. In one place on the flood plain of the American Fork River the soil is 90

percent cobblestones and gravel, and the matrix is light loamy to sandy material. Soil characteristics are obscured by the gravel and cobblestones, although in some places the surface layers are darkened by organic matter.

Included in the mapping are some gravelly sandy loam soils.

Trees grow in places, but rabbitbrush, cliffrose, and cheatgrass are the dominant plants.

This land has limited use for grazing and as wildlife habitat. Capability unit VIIs-UX4, nonirrigated.

Dagor Series

The Dagor series consists of deep, well-drained, noncalcareous, nearly level or gently sloping soils. These soils are on alluvial fans and flood plains of intermittent streams near the town of Alpine and near Santaquin city. They formed in alluvium from granite, quartzite, and schist.

Elevations range from 4,800 to 5,200 feet. The average annual precipitation ranges from 14 to 17 inches. The soils are usually moist but are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days during the summer. The mean annual soil temperature is 47° to 52° F., and the frost-free period is 150 to 170 days.

In a typical profile, the surface layer is very dark brown, mildly alkaline loam 6 inches thick. Below this, to a depth of 60 inches or more, is very dark brown to dark-brown, neutral loam.

The vegetation is dominantly big sagebrush, brushy Gambel oak, bluebunch wheatgrass, and spiked wheatgrass.

The Dagor soils are not extensive in this survey area. They are used mainly for irrigated crops and dryland wheat, but some areas are used for range.

Representative profile of Dagor loam in a cultivated field 3/4 mile north of the town of Alpine, at a point 1,000 feet east of the road, 400 feet west of the SE. corner of section 13, T. 4 S., R. 1 E.:

Ap--0 to 6 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure that parts to weak, medium, granular; hard, friable, slightly sticky, and plastic; common fine roots; few fine and medium pores; mildly alkaline (pH 7.5); clear, smooth boundary.

C1--6 to 24 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common fine roots; many fine, common medium and large pores; neutral (pH 7.3); diffuse, wavy boundary.

C2--24 to 36 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; massive; slightly hard, friable, sticky, and plastic; few fine roots; many fine and few medium pores; neutral (pH 6.9); gradual, wavy boundary.

C3--36 to 60 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; massive; slightly hard, friable, sticky, and plastic; very few fine roots; many fine and few medium pores; neutral (pH 6.9).

The A horizon is very dark brown, very dark grayish-brown, or dark-brown loam or silt loam. The upper part of the C horizon is very dark grayish-brown to very dark brown loam that contains more than 18 percent clay and less than 15 percent sand coarser than very fine sand. The lower part of the C horizon is similar to the upper part, but below a depth of 40 inches the texture ranges from silty clay loam to gravelly loamy sand. Reaction ranges from neutral to moderately alkaline.

Dagor loam (1 to 3 percent slopes) (Da).--A profile of this soil is the one described as typical of the series.

Included with this soil in mapping are small areas of soils that are calcareous below a depth of 40 inches. Also included in mapping are some gravelly sandy loam soils and, west of the town of Alpine, are small areas of soils having slopes of 3 to 6 percent.

This soil is well-drained and moderately permeable. It holds about 10 inches of available water in the upper 5 feet. Runoff is slow. Natural fertility is high. Roots penetrate to a depth of 5 feet or more. This soil is friable, easy to work, and absorbs moisture readily. The erosion hazard is slight.

This soil is used for irrigated alfalfa, corn, small grains, sugar beets, pasture, and apple orchards and is well suited to those uses. Some areas are used for dryland wheat and some for native range. Capability units I-1, irrigated, and IIIe-U, nonirrigated.

Dagor silt loam (1 to 3 percent slopes) (Db).--The profile of this soil is similar to that described as typical for the series, except that the surface texture is silt loam and the soil is slightly to moderately calcareous below a depth of 20 to 30 inches. This soil also contains more silt and very fine sand throughout the profile. It is on alluvial fans southeast of Santaquin city. Slopes are generally smooth and face west.

Included with this soil in mapping are small areas of soils that have a gravelly loam or sandy loam surface layer. Also included, east of Santaquin city, are two small areas of soils that have slopes of 3 to 6 percent.

This soil is well drained and is moderately permeable. It holds about 10 inches of available water in the upper 5 feet. Runoff is slow, and the erosion hazard is slight. Roots penetrate to a depth of 5 feet or more.

Most of this soil is used for growing irrigated alfalfa, corn, small grains, pasture, and apple orchards. Some areas are not farmed for lack of irrigation water. This soil is well suited to a wide variety of irrigated crops. Capability units I-1, irrigated, and IIIe-U, nonirrigated.

Dry Creek Series

The Dry Creek series consists of deep, well-drained, stony, or cobbly soils on alluvial fans and hillsides of ancient Lake Bonneville. Slopes range from 6 to 60 percent. These soils occur on the Traverse Range, east of Santaquin city and near the Goose Nest. They formed in alluvium or colluvium derived from mixed sedimentary rocks.

Elevations range from 5,200 to 5,700 feet. The average annual precipitation ranges from 14 to 18 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days during the summer The mean annual soil temperature is 47° to 50° F., and the frost-free period is 130 to 150 days.

In a typical profile, the surface layer is very dark grayish-brown, medium acid, cobbly loam about 9 inches thick. The subsoil is reddish-brown to dark-brown, slightly acid, very firm cobbly clay about 20 inches thick. The substratum is brown, strongly calcareous, mildly alkaline cobbly clay loam or very cobbly clay loam.

The vegetation is big sagebrush, brushy Gambel oak, western wheatgrass, and spiked wheatgrass.

Dry Creek soils are used as range for livestock and as wildlife habitat.

Representative profile of Dry Creek cobbly loam, 10 to 30 percent slopes, in a range area about one-fourth mile south of the power plant in the mouth of Dry Creek Canyon, at a point 250 feet south and 650 feet east of the NW. corner of section 17, T. 4 S., R. 2 E.:

A1--0 to 5 inches, dark grayish-brown (10YR 5/2) cobbly loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, platy structure that parts to moderate, fine, granular; slightly hard, friable, slightly sticky, and slightly plastic; common fine roots; few large and many fine pores; medium acid (pH 6.0); clear, smooth boundary.

A3--5 to 9 inches, brown (10YR 5/3) cobbly heavy loam, very dark grayish brown (10YR 3/2) when moist; strong, fine, angular blocky structure; hard, firm, sticky, and plastic; few large and common small pores; few thin clay films; medium acid (pH 6.0); clear, smooth boundary.

B21t--9 to 15 inches, brown (7.5YR 5/3) cobbly clay, dark brown (7.5YR 4/4) when moist; moderate, medium, prismatic structure that parts to strong, medium, angular blocky; very hard, firm, sticky, and very plastic; few fine and medium roots; common fine pores; common moderately thick clay films; medium acid (pH 5.8); gradual, smooth boundary.

B22t--15 to 26 inches, reddish-brown (5YR 5/3) cobbly clay, reddish brown (5YR 4/3) when moist; moderate, medium, prismatic structure that parts to strong, medium, angular blocky; very hard; very firm, very sticky, and very plastic; few fine and medium roots; few fine pores; many moderately thick clay films; slightly acid (pH 6.2); clear, wavy boundary.

B3ca--26 to 29 inches, very pale brown (10YR 7/3) very cobbly clay loam, yellowish brown (10YR 5/4) when moist; massive; hard, firm, sticky, and plastic; few fine roots; few fine pores; very strongly calcareous, lime is in soft masses and concretions; mildly alkaline (pH 7.8); clear, wavy boundary.

Cca--29 to 48 inches, very pale-brown (10YR 7/3) very cobbly clay loam, brown (10YR 5/3) when moist; massive; hard, firm, sticky, and plastic; few fine pores; no roots; very strongly calcareous, lime is in soft masses and concretions; mildly alkaline (pH 7.5).

The A horizon is very dark brown or very dark grayish brown and is 7 to 10 inches thick. The B2 horizon is reddish brown or dark brown in color and medium acid to neutral in reaction. The B3ca horizon is brown, dark-brown, yellowish-brown, or dark yellowish-brown, cobbly or very cobbly clay or clay loam. It has 35 to 60 percent coarse fragments and its lime content ranges from 6 to 47 percent. The Cca horizon ranges from cobbly loam or very cobbly loam to clay loam; the content of coarse fragments ranges from 35 to 70 percent. The lime content ranges from 15 to 49 percent.

Dry Creek cobbly loam, 10 to 30 percent slopes (DCF).--A profile of this soil is the one described as typical of the series. This soil occurs on old alluvial fans and hillsides. Generally, it occupies fairly large areas, but in Fort Canyon the areas are small.

Included with this soil in mapping are areas of a noncobbly Dry Creek loam that makes up about 20 percent of each area. Also included in the mapping are small areas of Picayune cobbly silt loam and some areas of soils having slopes of 6 to 10 percent.

This soil is well drained and slowly permeable. Root penetration is generally deep but in some places is restricted by the high content of lime and gravel in the substratum. This soil holds about 5 inches of available water in the uppermost 5 feet. Runoff is medium, and the erosion hazard is moderate. The natural fertility is moderate.

This soil is suited for the production of range forage, which is grazed by livestock in spring and fall and by deer in winter. Brush clearing and range seeding can be done by machinery, although the cobblestones on the surface may interfere with these practices. Capability unit VIe-U, nonirrigated.

Dry Creek Series, Thin Surface Variant

The Dry Creek series, thin surface variant, consists of deep, well-drained, very steep, gravelly, and cobbly soils. These soils occur on mountain ridges and are moderately eroded.

Slopes range from 30 to 60 percent and face west and northwest. These soils formed in alluvium and colluvium from mixed sedimentary rocks. The Dry Creek, thin surface variant, soils in this survey area are similar to normal Dry Creek soils but have a thinner surface layer.

Elevations range from 5,500 to 6,000 feet. The average annual precipitation ranges from 14 to 18 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 47° to 50° F., and the frost-free period is 130 to 150 days.

Typically, the surface layer of a Dry Creek soil, thin surface variant, is very dark grayish-brown, cobbly loam about 5 inches thick. The subsoil is dark-brown or reddish-brown, slightly acid, cobbly clay about 20 inches thick. The substratum is brown, mildly alkaline, very cobbly clay loam.

The vegetation consists of Gambel oak, big sagebrush, western wheatgrass, and spiked wheatgrass.

These soils are used for range and wildlife habitat.

Dry Creek cobbly loam, thin surface variant, 30 to 60 percent slopes, eroded (DRG2).--The profile of this soil is similar to that described as typical for the Dry Creek series, except that its surface layer is only 5 to 7 inches thick. This soil occurs on ridges, mainly on slopes that face west and northwest.

Included with this soil in mapping are small areas of Picayune cobbly silt loam.

Because of the slope, this soil has a severe erosion hazard. Sheet erosion is active, and rills and shallow gullies are common. In about 20 percent of the area, the surface layer is not cobbly.

The main vegetation is Gambel oak, western wheatgrass, spiked wheatgrass, and big sagebrush.

This Dry Creek soil is not extensive in the survey area. It is suited to the production of range forage, which is grazed by livestock in spring and fall and by wildlife in winter. Capability unit VIIe-U, nonirrigated.

Dry Creek Series, Stony Subsoil Variant

The Dry Creek series, stony subsoil variant, consists of deep, well-drained, extremely stony, and cobbly soils. These soils are on offshore bars, mud rockflows, and on ridges and hillsides near the shoreline of ancient Lake Bonneville. Slopes range from 6 to 30 percent. These soils formed in very cobbly and stony alluvium and colluvium derived from intermediate and basic igneous rocks. The stony subsoil variant of the Dry Creek series is similar to normal Dry Creek soils, but it has many more stones throughout the profile.

Elevations range from 5,200 to 6,000 feet. The average annual precipitation ranges from 14 to 18 inches. These soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days during the summer. The mean annual soil temperature is 47° to 50° F., and the frost-free period is 130 to 150 days.

In a typical profile of this variant, the surface layer is very dark grayish-brown, neutral, extremely stony loam about 4 inches thick. The subsoil is dark-brown, neutral, very firm, very cobbly heavy clay loam about 16 inches thick. The substratum is brown or strong-brown, mildly alkaline, very cobbly sandy loam or very cobbly sandy clay loam.

The vegetation is big sagebrush, Gambel oak, western wheatgrass, and spiked wheatgrass.

These Dry Creek soils are not extensive in this survey area. They are used for range and as wildlife habitat.

Representative profile of Dry Creek extremely stony loam, stony subsoil variant, 6 to 30 percent slopes, in a range area about three-fourths mile north of the Juab County line, on a ridge east of the Union Pacific Railroad, at a point 2,500 feet west and 700 feet south of the NE. corner of section 15, T. 10 S., R. 1 E.:

A1--0 to 4 inches, grayish-brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; slightly hard, friable, sticky, and slightly plastic; many very fine roots; common, fine, discontinuous pores; neutral (pH 6.8); clear, smooth boundary.

B1--4 to 10 inches, grayish-brown (10YR 5/2) cobbly clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky, and plastic; many very fine roots; common, fine, discontinuous pores; 20 to 50 percent stones and cobblestones; very few thin clay films on ped faces and pores; slightly acid (pH 6.5); clear, smooth boundary.

B21t--10 to 14 inches, brown (7.5YR 5/2) very cobbly heavy clay loam, dark brown (7.5YR 3/2) when moist; moderate, fine, angular blocky structure; very hard, very firm, very sticky, and very plastic; common very fine roots; few, very fine, discontinuous pores; 50 to 75 percent cobblestones and stones; common thin clay films on ped faces; neutral (pH 6.6); clear, wavy boundary.

B22t--14 to 20 inches, brown (7.5YR 5/3) very cobbly heavy clay loam, dark brown (7.5YR 3/3) when moist; moderate, fine, angular blocky structure; very hard, very firm, very sticky, and very plastic; few very fine roots; few, fine, discontinuous pores; 50 to 75 percent cobblestones and stones; common moderately thick clay films on ped faces and pores; neutral (pH 6.6); clear, wavy boundary.

B3--20 to 30 inches, pink (7.5YR 7/4) very cobbly sandy clay loam, brown (7.5YR 4/4) when moist; massive; hard, friable, nonsticky, and nonplastic; few very fine roots; few, fine, discontinuous pores; 60 to 80 percent cobblestones and stones; few thin clay films, mainly in pores; neutral (pH 6.8); gradual, wavy boundary.

C1ca--30 to 43 inches, pink (7.5YR 7/4) very cobbly sandy loam, brown (7.5YR 4/4) when moist; massive; hard, friable, nonsticky, and nonplastic; few very fine roots; no visible pores; 50 to 80 percent cobblestones; strongly

calcareous; thick lime coatings around cobblestones and in veins; mildly alkaline (pH 7.8); gradual, wavy boundary.

C2--43 to 60 inches, reddish-yellow (7.5YR 7/6) very cobbly sandy loam, strong brown (7.5YR 5/6) when moist; massive; hard, very friable, nonsticky, and nonplastic; few very fine roots; no visible pores; some lime coatings on gravel; mildly alkaline (pH 7.4).

Stones and boulders are 10 inches in diameter, 8 feet long, and 5 feet wide. The content of stones and cobblestones in the B2 horizon ranges from 50 to 75 percent, by volume. The C horizon may be less stony than the A and B horizons, but it has 50 to 80 percent gravel and cobblestones. Depth to the calcareous material ranges from 20 to 34 inches, but it is generally about 30 inches.

Dry Creek extremely stony loam, stony subsoil variant, 6 to 30 percent slopes (DEF).--The profile of this soil is the one described as typical for the stony subsoil variant of the Dry Creek series. It differs from the normal Dry Creek soils by having an extremely stony surface layer and many more stones and cobblestones throughout the profile.

Included with this soil in mapping are areas of cobbly and gravelly soils.

This soil is well drained and is moderately permeable. Roots generally penetrate to a depth of 5 feet or more, but the cobblestones and stones restrict root penetration in places. The soil holds about 5 inches of available water in the upper 5 feet. Most of the precipitation enters the soil. Runoff is medium, and the erosion hazard is moderate.

This soil is used for the production of range forage, which is grazed by livestock in spring and fall and by wildlife all year. Because of the stones and cobblestones, clearing brush by machinery is not feasible except in a few places. Capability unit VIIs-UX4, nonirrigated.

Gappmayer Series

The Gappmayer series consists of deep, well-drained, very gravelly or very cobbly, very steep soils. These soils are on north- and east-facing mountain slopes, east of the town of Salem. Slopes range from 50 to 70 percent. These soils formed in medium-textured, very cobbly alluvium and colluvium from mixed sedimentary rocks, mostly sandstone.

Elevations range from 5,500 to 7,100 feet. The average annual precipitation ranges from 18 to 25 inches. The soils are not usually dry, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 43° to 47° F. The mean summer temperature is 60° to 65° F., and the frost-free period is 80 to 90 days.

In a typical profile, the surface layer is very dark-brown, cobbly, neutral, light loam about 10 inches thick. The subsurface layer is brown to light yellowish-brown, slightly acid, very cobbly loam about 20 inches thick. Material from this layer tongues into the layer below. The subsoil is dark yellowish-brown, slightly acid, friable, very cobbly loam about 12 inches thick. The substratum is brown, neutral, very cobbly light loam.

The native vegetation consists of brushy Gambel oak, scattered conifers, maple, brouse, and grasses.

The Gappmayer soils are not extensive in this survey area. They are used for range, pasture, wildlife habitat, and watersheds.

Representative profile of Gappmayer cobbly loam, 50 to 70 percent slopes, in a range area about 1 mile south of the Dream Mine on the old Leader Mine Road, at a point 2,000 feet south and 1,000 feet east of the NE. corner of section 17, T. 9 S., R. 3 E.:

O1--2 inches to 0, oak leaves, twigs, and other plant leaves.

A11--0 to 6 inches, very dark grayish-brown (10YR 3/2) cobbly light loam, very dark brown (10YR 2/2) when moist; weak, very fine, granular structure; soft, very friable, nonsticky, and slightly plastic; common fine and few medium roots; common, fine, discontinuous pores; neutral (pH 6.7); clear, smooth boundary.

A12--6 to 10 inches, brown (10YR 4/3) cobbly light loam, dark brown (10YR 3/3) when moist; weak, very fine, granular structure; soft, very friable, nonsticky, and slightly plastic; many fine and few medium roots; many, fine, discontinuous pores; slightly acid (pH 6.5); clear, wavy boundary.

A21--10 to 19 inches, pale-brown (10YR 6/3) very cobbly light loam, brown (10YR 5/3) when moist; weak, thin, platy structure; soft, friable, nonsticky, and slightly plastic; common fine and few medium roots; common, fine, discontinuous pores; slightly acid (pH 6.5); clear, wavy boundary.

A22--19 to 30 inches, very pale brown (10YR 7/4) very cobbly loam, light yellowish brown (10YR 6/4) when moist; weak, very fine, subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common fine and few medium roots; common, fine, discontinuous pores; few thin clay films on ped faces and in pores; slightly acid (pH 6.4); gradual, wavy boundary.

A&B--30 to 44 inches, light yellowish-brown (10YR 6/4) very cobbly loam, yellowish brown (10YR 5/4) when moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky, and plastic; common fine and few medium roots; common, fine, discontinuous pores; common thin clay films on peds and in pores; slightly acid (pH 6.4); gradual, wavy boundary.

B2t--44 to 56 inches, light yellowish-brown (10YR 6/4) very cobbly loam, dark yellowish brown (10YR 4/4) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common fine and few medium roots; common thin clay

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films on ped faces and in pores; slightly acid (pH 6.5); clear, smooth boundary.

B3--56 to 63 inches, yellowish-brown (10YR 5/4) very cobbly light loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; common fine and very fine roots; common, fine, discontinuous pores; few thin clay films mainly in pores; neutral (pH 7.1); clear, smooth boundary.

The A1 horizon generally is very dark brown but ranges to very dark grayish brown. The A2 horizon ranges from light yellowish brown or yellowish brown to brown or pale brown sandy loam to light loam and is 40 to 60 percent coarse fragments. The B2t horizon is very cobbly light sandy clay loam to loam with 18 to 27 percent clay and 50 to 80 percent coarse fragments, mainly cobblestones. Color of the B2t horizon ranges from dark brown to dark yellowish brown in a hue of 10YR and from dark reddish brown to reddish brown in a hue of 5YR. The B3 horizon is similar to the B2t horizon in color, but it ranges from very cobbly light loam to fine sandy loam and is 50 to 80 percent cobblestones. Reaction ranges from medium acid to neutral.

Gappmayer cobbly loam, 50 to 70 percent slopes (GAG).--A profile of this soil is the one described as typical of the series.

Included with this soil in mapping, on ridges, south-facing slopes, and near rock outcrops, are small areas of a stony, unnamed soil that is shallow to sandstone bedrock. This soil and the rock outcrops make up about 15 percent of each area mapped.

This soil is well drained, and rapidly permeable. Root penetration is deep. The soil can hold about 3 inches of available water to a depth of 5 feet. Most of the precipitation enters the soil. Runoff is medium, and the erosion hazard is moderate. Small landslips are common. The natural fertility is high.

This soil is used for range by livestock early in summer and by deer in winter. Capability unit VIIe-M, nonirrigated.

Henefer Series

The Henefer series consists of deep, well-drained, gravelly or cobbly soils. These soils are on alluvial fans, on the Traverse Range, in Pole Canyon, and on the foothills south of Payson city. Slopes range from 5 to 70 percent. These soils formed in mixed cobbly alluvium or colluvium from weathered sandstone, argillite, and shale.

Elevations range from 5,600 to 7,000 feet. The average annual precipitation is 18 to 25 inches. The soils are usually moist, but they are dry in all parts between a depth of 7 and 20 inches for more than 60 consecutive days in the summer. The mean annual soil temperature is 44° to 47° F., and the frost-free period is 80 to 90 days. These soils are closely associated with the Rake soils.

In a typical profile, the surface layer is very dark-brown to very dark grayish-brown, neutral loam about 7 inches thick. The subsoil is dark reddish-brown, or reddish brown, slightly acid, very firm, cobbly clay about 41 inches thick. The substratum is brown or dark-brown, neutral, firm, very cobbly clay.

The vegetation consists of western wheatgrass, spiked wheatgrass, lupine, big sagebrush, brushy maple, and oak.

The Henefer soils are used for range, wildlife habitat, and watersheds.

Representative profile of Henefer loam, 35 to 70 percent slopes, in a range area on Picayune Mountain, 3 miles southeast of Payson city, at a point 2,000 feet east and 1,000 feet south of the NW. corner of section 34, T. 10 S., R. 2 E.:

A11--0 to 3 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate to strong, thin, platy structure; slightly hard, friable, slightly sticky, and plastic; common very fine roots; no pores; neutral (pH 7.3); clear, smooth boundary.

A12--3 to 7 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; hard, friable, sticky, and plastic; common fine and very fine roots; few medium and common fine pores; neutral (pH 6.8); clear, smooth boundary.

B11--7 to 15 inches, brown (7.5YR 5/3) heavy clay loam, dark brown (7.5YR 5/3) when moist; strong, medium, blocky structure; very hard, firm, sticky, and plastic; common, medium, fine and very fine roots; common fine and very fine pores; common thin clay films; slightly acid (pH 6.4); gradual, wavy boundary.

B21t--15 to 25 inches, reddish-brown (5YR 5/4) cobbly clay, dark reddish brown (5YR 3/3) when moist; moderate, medium, prismatic structure that parts to strong, medium, angular blocky; very hard, very firm, sticky, and very plastic; few, medium, fine and very fine roots; few very fine pores; thin continuous clay films; moderately thick continuous clay films on cobblestones; slightly acid (pH 6.1); clear, smooth boundary.

B22t--25 to 33 inches, reddish-brown (5YR 5/4) cobbly clay, reddish brown (5YR 4/4) when moist; moderate, coarse, prismatic structure that parts to moderate, coarse, blocky; extremely hard, extremely firm, sticky, and very plastic; few fine and very fine roots; few, very fine, discontinuous pores; moderately thick continuous clay films; slightly acid (pH 6.1); gradual, smooth boundary.

B23t--33 to 43 inches, reddish-brown (5YR 5/4) cobbly clay, reddish brown (5YR 4/4) when moist; strong, fine, blocky structure; extremely hard, extremely firm, sticky, and plastic; few very fine roots; common, very fine, discontinuous pores; moderately thick continuous clay films on peds; few slickensides; slightly acid (pH 6.1); gradual, wavy boundary.

B3--43 to 58 inches, light-brown (7.5YR 6/4) very cobbly clay, brown (7.5YR 4/4) when moist; strong, fine, blocky structure; hard, firm, sticky, and plastic; few very fine roots; no visible pores; moderately thick clay films on cobblestones; slightly acid (pH 6.4); gradual, wavy boundary.

C--58 to 65 inches, light-brown (7.5YR 6/4) very cobbly clay, brown (7.5YR 4/4) when moist; massive; hard, firm, sticky, and plastic; few very fine roots; no visible pores; moderately thick clay films on cobblestones; neutral (pH 6.6).

The combined thickness of the A and B horizons is more than 50 inches. The A horizon ranges from very dark brown or very dark grayish brown to dark brown. The dark color and the accumulation of organic matter extend to a depth of 20 to 25 inches. The B2t horizon ranges from dark reddish brown to reddish brown. The B3 horizon is brown to dark reddish-brown very cobbly clay to clay loam. The C horizon, below a depth of 50 inches, contains 50 to 80 percent coarse fragments. Reaction is medium acid to neutral.

Henefer loam, 35 to 70 percent slopes (HEG).--This soil has the profile described as typical for the Henefer series. It occurs at the head of Pole Canyon, mainly on slopes facing south and west.

Included with this soil in mapping are small areas of an unnamed soil, on the northerly and easterly slopes, that makes up about 20 percent of the mapped area. It has a surface layer less than 5 inches thick and the layers below are bleached.

The vegetation consists of scattered aspen and maple, and a few conifers.

This Henefer soil is well drained and is slowly permeable. It holds about 6 inches of available water in the upper 5 feet. Root penetration is deep but is somewhat restricted by gravel and cobblestones. Runoff is medium, and the erosion hazard is moderate.

The vegetation is mainly oakbrush and maple. Capability unit VIIe-M, nonirrigated.

Henefer-McPhie association, 5 to 30 percent slopes (HFF).--This association occurs near the top of the Traverse Mountain. About 60 percent is Henefer loam and 40 percent is McPhie sandy loam. The Henefer soil occupies slopes that face south and west, and the McPhie soil is on the east- and north-facing slopes. This McPhie soil has the profile described as typical for the McPhie series.

Included in mapping, in some small basin-like areas 2 to 4 acres in size, are soils that have a surface layer of silty local alluvium or colluvium as much as 3 inches thick. Water accumulates in these areas and they are covered by big sagebrush.

This Henefer soil has a profile like that described as typical for the series. There are some rills 4 to 6 inches deep and an occasional gully 1 to 3 feet deep. The surface layer is 3 to 4 inches thicker in the areas covered by oakbrush and big sagebrush than it is in the open areas.

The Henefer soil is slowly permeable, and the McPhie soil is moderately permeable. Both soils are well drained. Runoff is slow to medium, and the erosion hazard is slight to moderate. Natural fertility is high. The available water is about 6.5 inches to a depth of 5 feet.

These soils are suited to the production of range forage. Capability unit VIe-M, nonirrigated.

Henefer-McPhie association, 30 to 60 percent slopes, eroded (HFG2).--This association is on steep and very steep mountain slopes. About 80 percent is Henefer loam and 20 percent is McPhie cobbly sandy loam. Except that it is moderately eroded and its surface layer is 3 to 5 inches thinner, this Henefer soil has a profile similar to the one described as typical for the Henefer series. This McPhie soil is moderately eroded, otherwise its profile is like that described as typical for the McPhie series.

Included in mapping are small areas of an unnamed soil that has a clay loam subsoil and some areas having slopes of 70 percent. Also included, mainly on the ridges, are small areas of a Henefer soil that has 20 to 50 percent stones in the surface layer.

The Henefer soil is slowly permeable, and the McPhie soil is moderately permeable. Both soils are well drained and hold about 6 inches of available water in the upper 5 feet. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

The soils in this mapping unit are suited to the production of range forage. Capability unit VIIe-M, nonirrigated.

Henefer-Rake association, 35 to 70 percent slopes (HKG).--This association occurs in Payson Canyon and south of the Goose Nest. About 60 percent is Henefer loam and Henefer cobbly loam and 40 percent is Rake stony loam, eroded.

Included in mapping are small areas of Picayune cobbly silt loam and small areas of an unnamed soil that has a cobbly sandy loam surface layer underlain by a bleached layer. These soils occur as small pockets on north- and east-facing slopes that have a gradient of 30 to 35 percent.

Henefer loam and Henefer cobbly loam occur in equal amounts in this association. Henefer cobbly loam is in patches, generally on ridges.

The Henefer loam in this mapping unit has the profile described as typical for the Henefer series. Henefer cobbly loam has 20 to 50 percent cobblestones in the surface layer. These Henefer soils are well-drained and slowly permeable. They hold about 6 inches of available water. Root penetration is deep but is restricted in places by the gravel and cobblestones in the substratum. Most of the precipitation enters the soil. Runoff is medium, and the erosion hazard is moderate.

This Rake soil has a profile like that described for the Rake series, except it has only 1 to 3 percent stones in the surface layer. It is on ridges and steep slopes where the parent material is predominantly limestone. The vegetation on this soil is big sagebrush, scattered clumps of oakbrush, and spiked wheatgrass.

The vegetation consists largely of oakbrush and maple and a few scattered conifers.

These soils are used for the production of range forage that is grazed by livestock in spring and fall and by wildlife throughout the year. The Henefer soils are in capability unit VIIe-M, dryland; the Rake soil is in capability unit VIIs-UX3, nonirrigated.

Hillfield Series

The Hillfield series consists of deep, calcareous, well-drained soils. These soils occur mainly on the south- and west-facing lake-terrace escarpments that are north and east of Lehi city and south of the town of Salem. Slopes range from 10 to 60 percent. These soils formed in silty lake sediments of mixed origin.

Elevations range from 4,700 to 5,200 feet. The average annual precipitation is 12 to 14 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in the summer. The mean annual soil temperature is 50° to 54° F., and the frost-free period is 150 to 170 days.

In a typical profile, the surface layer is dark grayish-brown, strongly calcareous light silt loam about 12 inches thick. Below this is olive-brown to grayish-brown, strongly calcareous, friable silt loam or light loam about 28 inches thick. Below a depth of 40 inches is dark grayish-brown, strongly calcareous sandy loam.

The vegetation is mainly western wheatgrass, big sagebrush, rabbitbrush, yellowbrush, and scattered brushy Gambel oak.

The Hillfield soils are used mainly for dryland wheat and alfalfa and for range.

Representative profile of Hillfield silt loam, 10 to 20 percent slopes, in a dryland wheatfield 2 1/2 miles southwest of the town of Alpine, at a point 2,640 feet east and 1,320 feet north of the SW. corner of section 27, T. 4 S., R. 1 E.:

Ap--0 to 4 inches, light brownish-gray (10YR 6/2) light silt loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure that parts to weak, fine, granular; soft, friable, slightly sticky, and slightly plastic; common fine roots; common fine and very fine pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.7); clear, smooth boundary.

AC--4 to 12 inches, pale-brown (10YR 6/3) light silt loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, granular structure that parts to weak, fine, granular; hard, friable, slightly sticky, and slightly plastic; common fine roots; common very fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.9); clear, wavy boundary.

C1ca--12 to 26 inches, pale-brown (10YR 6/3) light silt loam, olive brown (2.5Y 4/3) when moist; weak, thick, platy structure; hard, friable, nonsticky, and nonplastic; few fine roots; common fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.2); gradual, wavy boundary.

C2ca--26 to 35 inches, pale-brown (10YR 6/3) light loam, light olive brown (2.5Y 5/3) when moist; massive; hard, friable, nonsticky, and nonplastic; few very fine roots; few very fine pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.

C3ca--35 to 40 inches, pale-brown (10YR 6/3) light loam, grayish brown (2.5Y 5/2) when moist; massive; hard, friable, slightly sticky, and slightly plastic; few very fine roots; very strongly calcareous; lime is disseminated; strongly alkaline (pH 8.7); clear, smooth boundary.

IIC4--40 to 60 inches, grayish-brown (2.5Y 5/2) sandy loam, dark grayish brown (2.5Y 4/2) when moist; massive; soft, very friable, nonsticky, and nonplastic; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.9).

The A horizon ranges from dark grayish brown to brown. The upper C horizon ranges from olive brown to light olive brown or dark grayish brown to grayish brown. The texture ranges from silt loam to light loam throughout the profile and less than 18 percent is clay and less than 15 percent is fine sand or coarser sand. The lime content ranges from 25 to 46 percent, and reaction ranges from moderately alkaline to strongly alkaline. The lower C horizon is similar to the upper C horizon, but it is stratified sandy material and contains less lime.

Hillfield silt loam, 10 to 20 percent slopes (HmE).--A profile of this soil is the one described as typical of the series. The surface layer ranges from 3 to 12 inches in thickness. It is typically silt loam but ranges from heavy loam to sandy loam. Below the surface layer, the texture generally is silt loam or loam but is very fine sandy loam in places. In a few places, this soil is only slightly calcareous in the surface layer.

Included with this soil in mapping are small areas of Welby soils that have a dark-colored surface layer and small areas of Taylorsville silty clay loam. East of Pleasant Grove, about 10 acres of a moderately saline soil is included.

This Hillfield soil is well drained and is moderately permeable. Roots penetrate deeply. The soil holds about 11 inches of available water. Runoff is rapid, and the erosion hazard is severe. The natural fertility is low.

This soil is used mainly for dryland wheat, alfalfa, and pasture. If available, irrigation water can be applied most efficiently by sprinklers. Capability unit VIe-U, nonirrigated.

Hillfield silt loam, 20 to 30 percent slopes (HmF).--The profile of this soil is similar to that described as typical for the series.

This soil is well drained and is moderately permeable. Roots penetrate deeply. The available water is about 11 inches to a depth of 5 feet. Runoff is rapid, and the erosion hazard is very severe.

This soil is used mainly for range, but small areas are used for dryland wheat. It is not well suited to irrigation because of the slope. Capability unit VIe-U, nonirrigated.

Hillfield-Layton complex, 30 to 60 percent slopes (HNG).--This complex is on lake-terrace escarpments, mainly near the Orem city cemetery (pl. II, bottom). It generally occupies areas, 200 to 300 feet wide and 1/2 to 1 mile long, that are parallel to the Wasatch Mountain. The Hillfield soil is on slopes that face west and south, and it makes up about 50 percent of the complex. The Layton soil occurs on slopes facing north, and it makes up about 30 percent of the complex.

The Hillfield soil has a silt loam surface layer and its profile is similar to the one described as typical for the Hillfield series. This soil is well drained and is moderately permeable. Runoff is rapid, and the erosion hazard is very severe.

The Layton soil has a loamy fine sand surface layer about 7 inches thick. Its profile is similar to that described as typical for the Layton series. Runoff is rapid, and the erosion hazard is very severe. This soil is well drained and is rapidly permeable.

Included with this complex in mapping are areas of unnamed soils that are similar to Hillfield soils, except they have a dark-colored surface layer. Also included are soils that are similar to Layton loamy fine sand and areas of a gravelly soil. Other inclusions are some areas of soils having slopes of 60 to 80 percent and a few areas of soils that have slopes of 20 to 30 percent. All of these inclusions make up about 20 percent of this complex.

The present vegetation is mainly sagebrush, Indian ricegrass, and scattered, brushy Gambel oak.

The soils in this complex are used exclusively for range. Capability unit VIIe-U, nonirrigated.

Hillfield-Sterling complex, 20 to 35 percent slopes (HOF).--This complex is on lake-terrace escarpments and on hillsides above the channels of Dry Creek and the American Fork River below the mouth of canyons. It occurs in large, narrow areas that generally parallel the stream channel.

About 50 percent of this complex is Hillfield silt loam, 20 to 30 percent slopes and about 50 percent is Sterling gravelly sandy loam on slopes of 20 to 35 percent. The Sterling soil is generally on the higher slopes above the Hillfield soil. Both soils have a profile similar to that described as typical for their respective series. Runoff is moderate from both soils, and the erosion hazard is very severe.

Included with this complex in mapping are some areas of soils having slopes of as much as 50 percent and areas of soils that have a noncalcareous subsoil.

The vegetation is mainly big sagebrush, scattered brushy Gambel oak, and bunchgrass.

The soils in this complex are used as range for livestock. The Hillfield soil is in capability unit VIe-U, dryland; the Sterling soil is in capability unit VIs-U4, nonirrigated.

Hillfield-Welby silt loams, 6 to 35 percent slopes (HpF).--These soils are in rolling or hilly areas on high lake terraces, mainly northwest of the town of Alpine. About 60 percent of this complex is Hillfield silt loam, 20 to 30 percent slopes, which is on the south- and west-facing slopes; about 40 percent is Welby silt loam, extended season, 6 to 10 percent slopes, eroded, which is on the north- and east-facing slopes. The profile of this Hillfield soil is similar to the one that is described as typical for the Hillfield series. This Welby soil is described in the Welby series.

Near the town of Alpine are areas of soils that have an overwash of gravelly, neutral sandy loam 6 to 36 inches thick. Because this gravelly alluvium is more resistant to erosion and protects the areas covered, the places that have a thin or no cover of overwash are more severely eroded. Other inclusions are areas of a Welby silt loam and of a Hillfield silt loam having slopes of 10 to 20 percent.

The vegetation is mainly big sagebrush, cheatgrass, and scattered clumps of brushy Gambel oak.

The Hillfield soil is used for range, and the Welby soil is used for dryland crops. The Hillfield soil is in capability unit VIe-U, dryland; the Welby soil is in capability unit IIIe-U, nonirrigated.

Holdaway Series

The Holdaway series consists of calcareous, poorly drained, nearly level soils that have a lime-cemented hardpan. These soils are on low lake terraces, mainly south of Lehi city, west of Vineyard Road, and north of Payson city. They developed in calcareous, silty, mixed lake sediments.

Elevations range from 4,400 to 4,550 feet. The average annual precipitation is 12 to 16 inches. The mean annual soil temperature is 48° to 50° F., and the frost-free period is 130 to 150 days.

In a typical profile, the surface layer is black silt loam about 13 inches thick. Below this is very dark-gray, strongly calcareous, friable silt loam about 7 inches thick, over a thick, dark-gray, indurated, lime hardpan. These soils have a strong lime horizon within 16 inches of the surface. The water table is at a depth of 30 to 40 inches.

The Holdaway soils are used for irrigated general crops and pasture.

Representative profile of Holdaway silt loam, in a cultivated field 1/4 mile west of the Lakeview church, at a point 1,200 feet south and 300 feet east of the NE. corner of section 33, T. 6 S., R. 2 E.:

Ap--0 to 7 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky, and slightly plastic; many fine roots; few fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.9); gradual, smooth boundary.

A1--7 to 13 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, medium, granular structure; hard, friable, slightly sticky, and slightly plastic; many medium and fine roots; few fine pores; strongly calcareous; lime is disseminated; mildy alkaline (pH 7.8); abrupt, wavy boundary.

C1cag--13 to 20 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; massive; weakly cemented, friable, nonsticky, and nonplastic; few fine roots; few fine and many medium pores; strongly calcareous, lime is disseminated and in flakes; mildly alkaline (pH 7.7); abrupt, wavy boundary.

C2camg--20 to 28 inches, gray (2.5Y 6/1) silt loam, very dark gray (2.5Y 3/1) when moist; massive; strongly cemented lime hardpan; few fine roots; very strongly calcareous; mildly alkaline (pH 7.7); abrupt, wavy boundary.

C3cag--28 to 32 inches, light-gray (10YR 7/1) silt loam, dark gray (10YR 4/1) when moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; many fine pores; very strongly calcareous; few lime nodules, but lime is mainly mildly alkaline (pH 7.8); clear, wavy boundary.

C4cam--32 to 44 inches, light-gray (10YR 7/1) indurated lime hardpan, dark gray (10YR 4/1) when moist; massive; some large segregated lime nodules; moderately alkaline (pH 8.1); abrupt, smooth boundary.

C5cam--44 to 55 inches, gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) when moist; massive; indurated lime nodules 1 to 5 inches in diameter make up about 80 percent of the total volume; moderate alkaline (pH 8.2); abrupt, wavy boundary.

C6camg--55 to 67 inches, light-gray (10YR 7/1) indurated lime hardpan, gray (10YR 6/1) when moist; many, coarse, prominent mottles of strong brown (7.5YR 5/6) when dry, dark greenish gray (5G 4/1) when moist; massive; moderately alkaline (pH 8.0); clear, smooth boundary.

The A horizon ranges from black or very dark gray to very dark brown or very dark grayish brown. The Cca horizon is black or very dark gray to very dark brown or very dark grayish brown. Texture is light clay loam to heavy silt loam between a depth of 10 inches and the top of the hardpan and is more than 18 percent clay and less than 15 percent sand coarser than very fine sand. The depth to the hardpan ranges from 20 to 40 inches. The hardpan is 8 to 14 inches thick, and layers of silt loam are between the hardpan layers. The soil material above the hardpan contains less than 40 percent lime, but the hardpan and the layers between the hardpans contain 36 to 74 percent calcium carbonate equivalent.

Holdaway silt loam (0 to 3 percent slopes) (Hr).--A profile of this soil is the one described as typical of the series. Depth to the hardpan ranges from 20 to 40 inches. In places there is 4 to 6 inches of weakly cemented, somewhat platy, strongly calcareous material on top of the hardpan. The surface of the hardpan has a troweled, smooth appearance in some areas. More than one layer of hardpan is common. In an area west of Spring Lake, the hardpan is dark brown.

Included with this soil in mapping are small areas of soils that lack a hardpan and small spots that are moderately saline and alkali. About 3/4 mile northwest of the Saratoga resort area are 70 acres that have been covered by 20 to 30 inches of loam and very fine sandy loam deposited by floods from Tickville Gulch. A small area south of Payson city has slopes of 3 to 6 percent. Water seeps from the bench above and keeps this area wet, and water is at the surface in places. In this area, the hardpan is discontinuous, but many lime nodules occur where there is no hardpan.

The water table is usually highest in spring and early in summer. Permeability is moderately slow above the hardpan, but it is very slow in the hardpan. Roots generally penetrate to the hardpan. The soil can hold 4 to 8 inches of available water, but the amount varies with depth to the hardpan. Runoff is very slow, and there is no erosion hazard. The natural fertility is high.

This soil is used mostly for alfalfa, small grains, corn, sugar beets, and pasture. Capability unit IIIw-25, irrigated.

Holdaway silt loam, strongly saline-alkali (0 to 1 percent slopes) (Hs).--The profile of this soil is similar to that described as typical for the series, except that it is strongly saline-alkali.

Included with this soil in mapping are small areas of soils that lack the hardpan and areas of soils that are moderately saline-alkali. A small acreage south and west of the Ironton steel plant has layers of very strong gypsum on top of the indurated lime hardpan; this soil formed in calcareous and gypsiferous lake sediments on low lake terraces, typically less than 20 feet above the present level of Utah Lake. These small areas occupy the tops of nearly level, low, broad ridges that are 3 to 8 feet higher than the surrounding soils.

Generally, the soil can hold about 2 inches of available water, but the salt content reduces the amount of water available to plants to about 1 inch. There is no erosion hazard. Drainage is generally not practical because there are no available outlets.

This soil is used as range for livestock. It is not suited to crops unless the soil is drained and leached of salt and alkali. Capability unit VIIw-285, nonirrigated.

Ironton Series

The Ironton series consists of deep, poorly drained, strongly calcareous, nearly level soils. These soils are on low lake terraces, mainly around the Springville fish hatchery. They formed in mixed, medium-textured, calcareous lake sediments that are moderately saline-alkali in places.

Elevations range from 4,490 to 4,550 feet. The average annual precipitation is 14 to 16 inches. The mean annual soil temperature is 49° or 50° F., and the mean summer soil temperature ranges from 65° to 75° F. The frost-free period is 130 to 150 days.

In a typical profile, the surface layer is very dark gray loam about 8 inches thick. Below this is very dark gray, mottled, strongly or very strongly calcareous, friable loam about 24 inches thick. Below a depth of 32 inches, is dark grayish-brown, moderately calcareous, very fine sandy loam. A layer of strong lime accumulation is within 16 inches of the surface. The water table is generally between a depth of 30 and 60 inches in undrained areas.

The vegetation consists of saltgrass and sedges.

Ironton soils are not extensive in the survey area. They are used for irrigated crops and pasture.

Representative profile of Ironton loam, in a cultivated field 1/4 mile south of the Springville fish hatchery, at a point 2,640 feet west and about 1,000 feet north of the SE. corner of section 28, T. 7 S., R. 3 E.:

Ap--0 to 8 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; weak, coarse, subangular blocky structure that parts to moderate, fine, granular; hard, friable, slightly sticky, and plastic; common very fine roots; many very fine and few fine pores; strongly calcareous, lime is disseminated; mildly alkaline (pH 7.7); clear, smooth boundary.

C1cag--8 to 17 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; few, fine, faint, dark grayish-brown (2.5Y 4/2) mottles; weak, fine, subangular blocky structure; hard, friable, slightly sticky, and plastic; few very fine roots; common very fine pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.7); gradual, smooth boundary.

C2cag--17 to 25 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; common, fine, distinct, olive-brown (2.5Y 4/4) mottles; massive; hard, friable, slightly sticky, and plastic; few very fine roots; few very fine pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.7); gradual, smooth boundary.

C3cag--25 to 32 inches, gray (10YR 6/1) loam, dark gray (10YR 4/1) when moist; common, medium, distinct, light olive-brown (2.5Y 5/4) mottles; massive; slightly hard, friable, slightly sticky, and slightly plastic; few very fine roots; few very fine pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.6); clear, smooth boundary.

IIC4g--32 to 60 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) when moist; common, medium, fine, olive-brown (2.5Y 4/3) mottles; massive; hard, very friable, nonsticky, and nonplastic; few very fine roots; no visible pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.7).

The A horizon ranges from black to very dark gray. The Cca horizon ranges from very dark gray to dark gray and have distinct mottles to a depth of 20 inches. The horizon of carbonate accumulation occurs above a depth of 16 inches. The Cca horizon is silt loam, loam, or very fine sandy loam that is more than 18 percent clay and more than 15 percent fine sand or coarser. The lower Cca horizon and the C horizon are dark grayish-brown or dark-gray to gray, moderately or strongly calcareous, stratified silty clay loam to very fine sandy loam. Reaction ranges from mildly to moderately alkaline. The lime content of the Cca horizon ranges from 23 to 40 percent.

Ironton loam (0 to 1 percent slopes) (Ir).--The profile of this soil is the one described as typical of the series.

Included with this soil in mapping are small areas of clay loams.

This Ironton soil is poorly drained. The water table usually occurs between depths of 30 and 60 inches, but it is higher in spring and early in summer in places.

Permeability is moderate, and roots penetrate to the level of the water table. The soil retains about 11 inches of available water in drained areas. Runoff is slow, and there is no erosion hazard. Natural fertility is high.

This soil is used to grow alfalfa, small grains, corn, and pasture. It is not suitable for orchards. Capability unit IIw-2, irrigated.

Ironton loam, moderately saline-alkali (0 to 1 percent slopes) (Is).--This soil is moderately saline-alkali, otherwise its profile is similar to that described as typical for the series.

Included with this soil in mapping, southeast of Lehi city, are a few small areas of soils that have a grayish-brown surface layer. South of Lehi city are small areas of soils that are gravelly below a depth of 24 inches. Near the Jordan River, north of the pumping plant, the soil contains more than 40 percent calcium carbonate and has a silt loam surface layer.

This soil is poorly drained and is moderately permeable. The salt content reduces the amount of water that is available to plants to about 7 inches. Runoff is slow, and the erosion hazard is none to slight.

This soil is used mostly for pasture, but if drained and reclaimed, it is suitable for growing

alfalfa, barley, sugar beets, or pasture. Because of its position, it is difficult to obtain adequate drainage outlets. Capability unit IIIw-27, irrigated.

Jordan Series

The Jordan series consists of deep, calcareous, somewhat poorly drained, very strongly saline-alkali, nearly level soils. These soils are on low terraces north of the town of Salem and north of the Geneva steel plant. They formed in fine-textured, calcareous, lake-laid sediments of mixed origin.

Elevations range from 4,490 to 4,580 feet. The average annual soil temperature is 47° to 50° F., and the frost-free period is 130 to 150 days.

In a typical profile, the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsoil is brown, very strongly saline, very firm clay to silty clay loam about 16 inches thick. The substratum consists of brown, laminated, clayey sediments that are very strongly saline and are mottled to a depth of 40 inches. Layers of strong lime and strong salt are within 20 inches of the surface. The water table is generally at a depth of 30 to 60 inches.

The vegetation consists of saltgrass, alkali sacaton, pickleweed, and greasewood, but about 75 percent of the surface is bare.

Jordan soils are not extensive in this survey area. They are used for range.

Representative profile of Jordan silt loam in native range 4,650 feet west and 150 feet north of the main office building of the Consolidated Steel Company, section 6, T. 6 S., R. 2 E.:

A1--0 to 1 inch, grayish-brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure; soft, very friable, nonsticky, and nonplastic; few fine roots; few very fine pores; slightly calcareous; strongly alkaline (pH 8.5); abrupt, smooth boundary.

A2--1 to 7 inches, light brownish-gray (10YR 6/2) light silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, platy structure; soft, very friable, nonsticky, and slightly plastic; common fine and very fine roots; common fine and very fine pores; slightly calcareous; very strongly alkaline (pH 9.2); abrupt, smooth boundary.

B2tsaca--7 to 15 inches, pink (7.5YR 7/3) clay, brown (7.5YR 5/3) when moist; moderate, medium, prismatic structure that parts to strong, medium, angular blocky; extremely hard, very firm, very sticky, and very plastic; few fine and very fine roots between peds; few very fine pores; continuous, moderately thick clay films on vertical ped surfaces; slightly calcareous on ped surfaces and strongly calcareous inside peds; lime is disseminated and is in soft nodules; very strongly alkaline (pH 10.0); very strongly saline; common salt veins; clear, smooth boundary.

B3saca--15 to 23 inches, pink (7.5YR 7/3) heavy silty clay loam, brown (7.5YR 5/3) when moist; moderate, medium, angular blocky structure; extremely hard, very firm, sticky, and very plastic; few fine and very fine roots; common very fine pores; few thin clay films; strongly calcareous; lime is disseminated and is in soft nodules; very strongly alkaline (pH 10.0); very strongly saline; gradual, smooth boundary.

C1saca--23 to 40 inches, very pale-brown (10YR 8/3) heavy silty clay loam, brown (10YR 5/3) when moist; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; very hard, very firm, sticky, and very plastic; few very fine roots; common very fine pores; strongly calcareous; lime is disseminated; very strongly alkaline (pH 9.8); very strongly saline; gradual, wavy boundary.

C2ca--40 to 55 inches, very pale-brown (10YR 8/3) heavy silty clay loam, brown (10YR 5/3) when moist; common, medium, distinct, dark brown (7.5YR 4/4) mottles; massive; hard, very firm, very sticky, and very plastic; few very fine roots; common very fine pores; strongly calcareous; lime is disseminated; very strongly alkaline (pH 9.7); very strongly saline; clear, smooth boundary.

C3--55 to 60 inches, very pale-brown (10YR 7/3) silty clay loam, brown (10YR 5/3) when moist; many, coarse, prominent, strong-brown (7.5YR 5/6) mottles; weak, thick, platy structure (laminated lake sediments); very hard, very firm, very sticky, and very plastic; no roots; no visible pores; strongly calcareous; lime is disseminated; strongly saline; very strongly alkaline (pH 9.4).

The A horizon ranges from dark grayish-brown to very dark grayish-brown silt loam to very sandy loam. It ranges from noncalcareous to slightly calcareous and is from 2 to 7 inches thick. The B horizon is dark-brown to brown heavy silty clay loam or silty clay. The surface of the peds is slightly calcareous and has moderately clay coatings; the interior is strongly calcareous and has fine lime nodules. The C horizon consists of laminated lake-laid sediments of silty clay to loamy fine sand texture. The salt content of the B and C horizons ranges from 1.5 to 3 percent. Reaction ranges from moderately alkaline to very strongly alkaline throughout. The content of exchangeable sodium is more than 35 percent in the B and C horizons.

Jordan silt loam (0 to 1 percent slopes) (Jo).--This soil has the profile described as typical of the series. It is moderately saline-alkali in the surface layer. Below a depth of about 9 inches, it is very strongly saline-alkali. Distinct mottles occur at some depth between 20 and 40 inches. The substratum ranges from silty clay to loamy fine

sand but is typically silty clay loam. Hummocks 6 to 12 inches high occur in places.

Included with this soil in mapping are small areas of slightly or moderately saline-alkali Payson soils.

This Jordan soil is somewhat poorly drained and very slowly permeable. Depth of root penetration is restricted by a very high salt content and by laminated, platy clay layers. This soil holds about 11 inches of water in the root zone, but the very high salt content of the subsoil and substratum reduces the amount of water available to plants to about 2 inches. Runoff is very slow and, in places, water stands on the surface until it evaporates. There is no water erosion hazard, but wind erosion is a moderate hazard. The natural fertility is low.

This soil is used mainly for range. The strong salt and alkali content make it unsuitable for cultivation. Capability unit VIIw-285, nonirrigated.

Keigley Series

The Keigley series consists of deep, calcareous, well-drained soils. These soils are on low stream terraces and alluvial fans near the town of Palmyra and north of Santaquin city. They formed in moderately fine textured, calcareous, mixed alluvium weathered from sedimentary rocks. Slopes range from 0 to 3 percent.

Elevations range from 4,500 to 5,200 feet. The average annual precipitation is 14 to 16 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature ranges from 49° to 54° F., and the frost-free period is 130 to 170 days.

In a typical profile, the surface layer is dark-brown, calcareous, silty clay loam about 27 inches thick. Below this is brown, strongly calcareous, firm, silty clay loam.

The vegetation consists of wheatgrasses, big sagebrush, cheatgrass, and annual weeds.

Keigley soils are not extensive in this survey area. They are used for irrigated crops, orchards, and pasture.

Representative profile of Keigley silty clay loam, 1 to 3 percent slopes, in a cultivated field about 2 miles east of Santaquin city, at a point 200 feet east and 300 feet south of the NW. corner of section 31, T. 9 S., R. 2 E.:

Ap--0 to 7 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; weak, thick, platy structure that parts to weak, medium, subangular blocky; hard, firm, sticky, and plastic; few very fine roots; few medium and fine pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.8); abrupt, smooth boundary.

A12--7 to 19 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky, and very plastic; few very fine roots; common fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.9); gradual, smooth boundary.

A13--19 to 27 inches, light-brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 3/3) when moist; weak, medium, subangular blocky structure; very hard, firm, sticky, and very plastic; few fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.0); gradual, smooth boundary.

C1--27 to 42 inches, light-brown (7.5YR 6/3) silty clay loam, brown (7.5YR 5/3) when moist; massive; very hard, firm, slightly sticky, and plastic; common fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.9); gradual, smooth boundary.

C2--42 to 65 inches, light-brown (7.5YR 6/3) silty clay loam, brown (10YR 5/3) when moist; massive; hard, firm, slightly sticky, and plastic; common very fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.0).

The A horizon is dark brown to very dark grayish brown or very dark brown and is 20 to 30 inches thick. The C horizon is light-brown to dark-brown silty clay loam or clay loam that is 27 to 35 percent clay and less than 15 percent sand coarser than very fine sand. Below a depth of 40 inches, the texture ranges from silty clay loam to fine sandy loam and stratification is common. Reaction ranges from moderately alkaline to strongly alkaline, and the lime content ranges from 15 to 30 percent.

Keigley silty clay loam, 0 to 1 percent slopes (KeA).--This soil occurs mainly on the Spanish Fork River flood plain. Its profile is similar to that described as typical for the series. Runoff is slow, and there is no erosion hazard.

Included with this soil in mapping are a few small, somewhat poorly drained areas and also small areas of soils that have loam texture.

This Keigley soil is well drained and is moderately slowly permeable. It can hold about 12 inches of water that is available to plants. The natural fertility is moderate, and roots penetrate deeply. The frost-free period is 130 to 150 days.

This soil is well suited to the production of irrigated alfalfa, small grains, sugar beets, and pasture. Capability unit IIc-2, irrigated.

Keigley silty clay loam, 1 to 3 percent slopes (KeB).--A profile of this soil is the one described as typical of the Keigley series. The surface layer is typically light silty clay loam. Below a depth of 40 inches is stratified silty clay to fine sandy loam. This soil is nonsaline to slightly saline.

Included with this soil in mapping are small spots of strongly saline soils and areas of a Taylorsville silty clay loam and of a Pleasant Vale loam.

This soil is well drained and is moderately slowly permeable. It holds about 12 inches of water available to plants. Root penetration is deep. Runoff is slow, but water erosion is a slight hazard. The natural fertility is moderate. The frost-free period is 130 to 150 days.

This soil is well suited to the production of irrigated alfalfa, small grains, sugar beets, corn, and pasture. Capability unit IIe-2, irrigated.

Keigley silty clay loam, extended season, 0 to 2 percent slopes (KgA).--This soil occurs on the alluvial fan north of Santaquin city. Its profile is similar to that described as typical for the series.

Included with this soil in mapping are small areas of a somewhat poorly drained soil and small areas of a soil that has loam texture.

This Keigley soil is well drained and is moderately slowly permeable. It holds about 12 inches of available water. The frost-free period is 150 to 170 days. Runoff is slow, and there is no erosion hazard.

Most of the acreage is used for alfalfa, corn, sugar beets, small grains, apple and pear orchards, and pasture. Capability unit I-1, irrigated.

Kidman Series

The Kidman series consists of deep, well-drained, mildly alkaline soils. These soils are on high lake terraces, mainly on the Orem and Mapleton Benches. Slopes are 0 to 6 percent. These soils formed in wind-worked, sandy lake sediments derived mainly from sandstone and quartzite.

Elevations range from 4,700 to 5,100 feet. The average annual precipitation is 15 to 19 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 48° to 52° F., and the frost-free period is 150 to 170 days.

In a typical profile, the surface layer is dark-brown, mildly alkaline, very fine sandy loam about 8 inches thick. The subsoil is brown, very friable, very fine sandy loam about 12 inches thick. The substratum is brown, mildly alkaline, very fine sandy loam to light loam. A horizon of lime accumulation occurs at some depth between 30 and 60 inches.

The vegetation consists of big sagebrush, bunchgrass, cheatgrass, and scattered clumps of brushy Gambel oak.

Kidman soils are used for irrigated crops, orchards, and pasture.

Representative profile of Kidman very fine sandy loam, 0 to 1 percent slopes, in a cultivated field 1/2 mile north and 1/2 mile west of Mapleton church in the center of section 10, T. 8 S., R. 3 E.:

Ap--0 to 8 inches, brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) when moist; weak, medium and fine, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky, and slightly plastic; common fine and very fine roots; few fine pores; mildly alkaline (pH 7.8); clear, smooth boundary.

B2--8 to 20 inches, light-brown (7.5YR 5/4) very fine sandy loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky, and slightly plastic; few very fine roots; few fine pores; mildly alkaline (pH 7.6); gradual, wavy boundary.

C1--20 to 32 inches, brown (7.5YR 5/4) very fine sandy loam, brown (7.5YR 4/4) when moist; massive; slightly hard, very friable, nonsticky, and nonplastic; few very fine roots; few fine pores; mildly alkaline (pH 7.6); gradual, smooth boundary.

C2--32 to 44 inches, brown (7.5YR 5/4) very fine sandy loam, brown (7.5YR 4/4) when moist; massive; slightly hard, very friable, nonsticky, and nonplastic; few very fine roots; few fine pores; mildly alkaline (pH 7.6); clear, smooth boundary.

C3ca--44 to 60 inches, pink (7.5YR 7/4) light loam, brown (7.5YR 5/4) when moist; massive; slightly hard, very friable, nonsticky, and nonplastic; few very fine roots; few very fine pores; moderately calcareous; lime is disseminated and is in fine pores; moderately alkaline (pH 8.0).

The A horizon is dark brown or very dark grayish brown. The B horizon ranges from brown to dark-brown or yellowish-brown very fine sandy loam to fine sandy loam. The C horizon is loam, very fine sandy loam, fine sandy loam, or loamy sand. The Cca horizon contains 10 to 30 percent lime. Reaction is mildly alkaline or moderately alkaline.

Kidman very fine sandy loam, 0 to 1 percent slopes (KmA).--A profile of this soil is the one described as typical of the series. The surface layer ranges from 6 to 10 inches in thickness. In some places mottles occur below a depth of 40 inches.

Included with this soil in mapping are small areas of fine sandy loam, small areas of Timpanogos soils that have a loam subsoil, and small areas of a Layton loamy fine sand. Also included in mapping, southwest of Payson city, is a small acreage of soils that have a calcareous, sandy clay loam surface layer 8 to 14 inches thick.

This soil is well drained and is moderately permeable. It retains about 7.5 inches of water that is available to plants. Runoff is slow, but wind erosion is a slight hazard. The natural fertility is moderate. Plant roots penetrate deeply.

Most of this soil is well suited to irrigation and produces alfalfa, sugar beets, pasture, corn, small grains, and cherry, peach, apple, and pear orchards. Capability unit I-1, irrigated.

Kidman very fine sandy loam, 1 to 3 percent slopes (KmB).--This soil has a profile similar to that described as typical for the series. Where this soil joins gravelly soils, the profile contains gravelly sand below a depth of 36 inches.

Included with this soil in mapping, northeast of the town of Alpine, are small areas that have a loam surface layer and a sandy loam subsoil and that do not contain lime to a depth of 60 inches. Southwest of Payson is a small acreage that has a calcareous light sandy clay loam surface layer 8 to 14 inches thick.

This soil is well drained and is moderately permeable. It can hold about 7.5 inches of water available to plants. Runoff is slow, and the erosion hazard is slight.

This soil is used mainly for irrigated alfalfa, corn, sugar beets, small grains, pasture, and cherry, peach, apple, and pear orchards. Capability unit IIe-1, irrigated.

Kidman very fine sandy loam, 3 to 6 percent slopes (KmC).--This soil has a profile similar to that described as typical for the series.

Included with this soil in mapping are small areas of a Layton loamy fine sand. Also included in the mapping are two small areas of soils that have a sandy clay loam subsoil; one area is 1/2 mile northwest of the mouth of Battle Creek Canyon and the other area is about 3/4 mile northwest of the Orem city water storage tank. Both areas are on undulating topography and slopes are between 3 and 10 percent. Southwest of Payson city is a soil that is slightly calcareous in the surface layer.

This Kidman soil is well drained and moderately permeable. It holds about 7.5 inches of water available to plants. Runoff is medium, and the erosion hazard is moderate.

This soil is used mostly for irrigated small grains, alfalfa, and pasture, and for cherry, apple, pear, and peach orchards. Capability unit IIIe-1, irrigated.

Kilburn Series

The Kilburn series consists of deep, well-drained to somewhat excessively drained soils. These soils are very gravelly in most places but are cobbly or stony in some places. They occur on alluvial fans and colluvial slopes near the town of Alpine and on the Traverse Range. Slopes range from 3 to 50 percent. These soils formed in moderately coarse textured alluvium and colluvium, mainly from quartzite and granite.

Elevations range from 4,600 to 5,700 feet. The average annual precipitation is 15 to 19 inches. The soils are usually moist, but they are dry in all parts at depths between 7 and 20 inches for more than 60 consecutive days in summer. The average annual soil temperature is 47° to 52° F., and the frost-free period is 150 to 170 days.

In a typical profile, the surface layer is very dark brown to very dark grayish-brown, very gravelly sandy loam about 15 inches thick. The subsoil is dark-brown, friable, very gravelly sandy loam about 20 inches thick. The substratum is brown very gravelly sandy loam.

The vegetation consists of bluebunch wheatgrass, cheatgrass, big sagebrush, herbaceous sagebrush, and bitterbrush.

The Kilburn soils are used for grazing livestock and as wildlife habitat.

Representative profile of Kilburn very gravelly sandy loam, 30 to 50 percent slopes, eroded, in a range area 1.6 mile north of the junction of U.S. Highways Nos. 80 and 89, then east about 1.6 miles, in the NE. 1/4 of section 24, T. 4 S., R. 1 W.:

A11--0 to 8 inches, dark grayish-brown (10YR 4/2) very gravelly sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; soft, very friable, nonsticky, and nonplastic; common fine and very fine roots; neutral (pH 6.8); clear, smooth boundary.

A12--8 to 15 inches, dark grayish-brown (10YR 4/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard, friable, slightly sticky, and slightly plastic; common fine and very fine roots; common fine pores; neutral (pH 7.0); gradual, wavy boundary.

B2--15 to 25 inches, brown (10YR 5/3) very gravelly sandy loam, dark brown (10YR 4/3) when moist; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine roots; common fine pores; neutral (pH 7.0); gradual, wavy boundary.

B3--25 to 36 inches, pale-brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; slightly hard, very friable, slightly sticky, and slightly plastic; common very fine roots; common fine and medium pores; neutral (pH 7.0); abrupt, wavy boundary.

C1--36 to 40 inches, pale-brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) when moist; massive; slightly hard, very friable, nonsticky, and nonplastic; few very fine roots; common fine pores; neutral (pH 7.0); lime coatings on the bottom of gravel; clear, wavy boundary.

C2ca--40 to 60 inches, very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 5/3) when moist; massive; soft, very friable, nonsticky, and nonplastic; few very fine roots; neutral (pH 7.2); moderately calcareous.

The A horizon ranges from very dark brown or very dark grayish brown to dark brown in color and from 8 to 20 inches in thickness. It is gravelly to very gravelly fine sandy loam to sandy loam or light loam that is 20 to 50 percent gravel, cobblestones, or stones. The B horizon is dark-brown, brown, or dark yellowish-brown very gravelly sandy loam to loam that is 35 to 70 percent coarse fragments. The

C horizon is very gravelly sandy loam to loamy sand that is 50 to 70 percent coarse fragments. Reaction ranges from neutral to mildly alkaline.

Kilburn gravelly fine sandy loam, 15 to 30 percent slopes, eroded (KRE2).--This soil occurs on south- and west-facing slopes of alluvial fans and colluvial slopes near the Traverse Range. Slopes are less than 15 percent in some places. This soil has a profile similar to the one described as typical for the series.

Rills and gullies 2 to 5 feet deep and 200 to 600 feet apart are in places. On the east side of Fort Canyon, surface stones and boulders are common. The content of gravel and cobblestones increases with depth. Below a depth of 36 inches, the coarse fragments are mainly sand, gravel, and cobblestones.

Included with this soil in mapping are areas of a soil that formed in nongravelly, silty lake sediments. Also included, near the "Point of the Mountain", are small areas of highly erodible loamy coarse sand.

This soil is somewhat excessively drained and is rapidly permeable. It holds about 3.5 inches of water that is available to plants. Runoff is medium, and the erosion hazard is moderate.

This soil is suited to range. Capability unit VIs-U4, nonirrigated.

Kilburn stony sandy loam, 3 to 15 percent slopes (KOD).--This soil has a profile similar to that described as typical for the series. The surface layer is 20 to 50 percent stones and cobblestones, and stones occur throughout the soil.

Included with this soil in mapping are small areas of an unnamed soil that has a cobbly or stony clay loam subsoil.

This soil is somewhat excessively drained and is rapidly permeable. It holds about 3.5 inches of available water. Most of the precipitation enters the soil. The erosion hazard is moderate.

This soil is suited for the production of range forage that is grazed by livestock in spring and fall and by wildlife in winter. Capability unit VIs-U4, dryland.

Kilburn very gravelly sandy loam, 30 to 50 percent slopes, eroded (KNG2).--A profile of this soil is the one described as typical of the series. This soil is on steep and very steep hillsides, mainly in areas near the "Point of the Mountain" and east of the town of Alpine.

Included with this soil in mapping are rock outcrops and, in the canyon bottoms, small areas of Cleverly soils. The Cleverly soils have a gravelly sandy loam subsoil. Other inclusions are an unnamed soil that has a gravelly clay loam subsoil and soils having slopes of 50 to 70 percent.

This soil is somewhat excessively drained and is rapidly permeable. The hazard of erosion is severe. This soil holds about 3.5 inches of water available to plants. In places bedrock is within 30 inches of the surface. This soil is moderately affected by soil creep and local wash. Trails made by sheep have been accentuated by soil creep.

This soil is suited to the production of range forage. Capability unit VIIs-UX4, nonirrigated.

Kirkham Series

The Kirkham series consists of deep, calcareous, nearly level, somewhat poorly drained soils. These soils are mainly on the alluvial fans and flood plain of the Spanish Fork River, near the towns of Palmyra, Lake Shore, and Benjamin. They formed in moderately fine textured, mixed alluvium derived mainly from limestone, shale, and granite.

Elevations range from 4,500 to 4,600 feet. The annual precipitation is 13 to 17 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 90 consecutive days in summer. The mean annual soil temperature is 49° or 50° F., and the frost-free period is 130 to 150 days.

In a typical profile, the surface layer is dark-brown, strongly calcareous silty clay loam about 11 inches thick. Below this is dark-brown or dark grayish-brown, firm silty clay loam that is about 17 inches thick and grades to dark grayish-brown or brown silt loam. Distinct mottles occur at some depth between 20 and 40 inches.

The vegetation consists of saltgrass, sacaton, greasewood, and reeds.

Kirkham soils are used for commonly grown irrigated crops and for pasture.

Representative profile of Kirkham silty clay loam in a cultivated field 1/2 mile east and 1/4 mile south of the town of Lake Shore, at a point 2,400 feet east and 1,300 feet north of the SW. corner of section 16, T. 8 S., R. 2 E.:

Ap--0 to 11 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; very hard, firm, slightly sticky, and plastic; common very fine roots; few, fine, discontinuous, vertical, tubular pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.1); clear, smooth boundary.

C1--11 to 17 inches, pale-brown (10YR 6/3) silty clay loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; very hard, firm, slightly sticky, and plastic; few very fine roots; common very fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.3); clear, smooth boundary.

C2--17 to 28 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, subangular blocky structure; very hard, firm, slightly sticky, and plastic; few very fine roots; few very fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.3); gradual, smooth boundary.

C3--28 to 42 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) when moist; few, medium, distinct, brown (7.5YR 4/3) mottles; variegated colors of the soil mass are light brown (7.5YR 6/4) and reddish brown (5YR 4/3) when moist; massive; very hard, very firm, sticky, and very plastic; few very fine roots; few very fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.2); abrupt, smooth boundary.

C4--42 to 50 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; few, fine, distinct, dark-brown (7.5YR 4/4) mottles; variegated colors of the soil mass include grayish brown (2.5Y 5/2) when moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; no visible roots or pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.2); clear, smooth boundary.

C5--50 to 65 inches, pinkish-gray (7.5YR 6/2) light silt loam, brown (7.5YR 4/2) when moist; few, fine, distinct, dark reddish-brown (5YR 4/4) mottles; massive; slightly hard, very friable, nonsticky, and slightly plastic; no visible roots or pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.1).

The A horizon is dark brown or dark grayish brown and is 7 to 12 inches thick. The uppermost part of the C horizon ranges from clay loam or silty clay loam to silty clay, but its clay content averages 28 to 35 percent. The texture ranges from light loam to fine sandy clay loam below a depth of 40 inches. Depth to the water table ranges from 30 to 60 inches. The soil is slightly saline to strongly saline and moderately to very strongly alkaline. The lime content ranges from 6 to 30 percent. The content of organic matter in the A horizon is 2 to 4 percent, but it decreases irregularly as depth increases.

Kirkham silty clay loam (0 to 1 percent slopes) (Ks).--A profile of this soil is described as typical of the series. The surface layer is 7 to 12 inches thick. In an area south of Lehi city, this soil is moderately calcareous and contains numerous mica flakes. On the flood plain of the Spanish Fork River, the soil material is stratified below a depth of 30 inches. The substratum ranges from silty clay to fine sandy loam, but the sandy textures are dominant. The water table fluctuates but is generally highest during the irrigation period. This soil is typically nonsaline to slightly saline but is moderately saline and strongly saline in small areas.

Included with this soil in mapping are small areas of a Pleasant Vale loam, small areas of a Benjamin silty clay and, in a few places, areas of soils that contain gravel below a depth of 36 inches.

This soil is somewhat poorly drained and is moderately slowly permeable. Plants generally root deep, but rooting depth is restricted by the water table in places. This soil can hold about 11 inches of available water. Runoff is slow, and there is no erosion hazard. The natural fertility is moderate.

This soil is used mainly for the production of alfalfa, small grains, sugar beets, corn, and improved pasture. Capability unit IIw-2, irrigated.

Kirkham silty clay loam, moderately saline-alkali (0 to 1 percent slopes) (Kt).--This soil is moderately saline-alkali, but its profile is otherwise similar to that described as typical for the series. The salt content reduces the amount of water available to plants to about 8 inches. South of Lehi city, this soil is over lake sediments that are within 3 to 5 feet of the surface in many places. A fairly large area is about 1 1/2 miles north of the town of Palmyra. It consistently has layers of loam to sandy loam below a depth of 30 inches.

Included with this soil in mapping are small areas of nonsaline-alkali soils and spots of strongly saline-alkali soils.

This soil is somewhat poorly drained. Runoff is slow, and there is no erosion hazard. Drainage and reclamation are slow and difficult because of the slow permeability and lack of drainage outlets.

This soil is used mostly for pasture, but some areas are cultivated. Alfalfa, sugar beets, and barley are grown in places, but yields are low. If drained and reclaimed, this soil is suited to improved irrigated pasture, grass-legume hay, corn, and small grains. Capability unit IIIw-27, irrigated.

Kirkham silty clay loam, strongly saline-alkali (0 to 1 percent slopes) (Ku).--The profile of this soil is similar to that described for the series, except that it is mainly strongly saline-alkali. Salt crusts are on the surface in places, and in some small areas the soil is very strongly saline-alkali. There are some small areas of moderately saline-alkali soils.

This soil is somewhat poorly drained and is slowly permeable. Runoff is slow, and there is no erosion hazard. The natural fertility is low. Drainage and reclamation is difficult, or impossible, because of the slow permeability and the lack of drainage outlets. The salt content reduces the amount of available water to about 2 inches.

This soil is not suitable for crop production unless it is drained and reclaimed. The vegetation is a sparse growth of greasewood, saltgrass, and other salt-tolerant plants.

This soil is used for native pasture. Seedings of tall wheatgrass are possible in areas where irrigation water is available for starting seedlings. Capability unit VIIw-285, nonirrigated.

Lakewin Series

The Lakewin series consists of well-drained, deep, gravelly soils. These soils are on lake terraces,

mainly south of Payson city and on the Orem Bench in the vicinity of Grandview. Slopes range from 1 to 30 percent. These soils formed in gravelly lake sediments derived from quartzite, limestone, and granite.

Elevations range from 4,600 to 5,100 feet. The average annual precipitation is 14 to 16 inches. The soils are usually moist, but they are dry in all parts between depths of 8 and 24 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 48° to 52° F. The frost-free period is 150 to 170 days.

In a typical profile, the surface layer is very dark grayish-brown gravelly fine sandy loam about 10 inches thick. The subsoil is dark-brown, friable, gravelly fine sandy loam and very gravelly sandy loam about 17 inches thick. The substratum is dark grayish-brown, strongly calcareous, very gravelly sand.

The native vegetation is big sagebrush, bluebunch wheatgrass, and scattered clumps of Gambel oak.

Lakewin soils are used for irrigated orchards, alfalfa, small grains, and pasture.

Representative profile of Lakewin gravelly fine sandy loam, 1 to 6 percent slopes, in an abandoned orchard about 150 feet north of the road and 3/4 mile west of the Grandview school, about 600 feet west of the center of section 35, T. 6 S., R. 2 E.:

A11--0 to 3 inches, dark grayish-brown (10YR 4/2) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, granular structure; hard, friable, slightly sticky, and slightly plastic; common very fine roots; many, fine and very fine, discontinuous pores; neutral (pH 7.3); abrupt, smooth boundary.

A12--3 to 10 inches, dark grayish-brown (10YR 4/2) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky, and slightly plastic; common very fine roots; common, very fine, discontinuous pores; noncalcaroeus; mildly alkaline (pH 7.4); clear, smooth boundary.

B21--10 to 19 inches, brown (10YR 5.3) gravelly fine sandy loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; hard, friable, nonsticky, and slightly plastic; few very fine roots; common, fine, discontinuous pores; mildly alkaline (pH 7.4); gradual, wavy boundary.

B22--19 to 27 inches, pale-brown (10YR 6/3) very gravelly sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard, very friable, nonsticky, and slightly plastic; common very fine roots; many, very fine, discontinuous pores; noncalcareous; thin lime coating on underside of gravel; neutral (pH 7.2); gradual, wavy boundary.

IIC1ca--27 to 37 inches, grayish-brown (10YR 5/2) very gravelly sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry and moist, nonsticky, and nonplastic; common very fine roots; strongly calcareous; lime is disseminated; thick lime coatings on gravel; mildly alkaline (pH 7.7); clear, smooth boundary.

IIC2ca--37 to 60 inches, light brownish-gray (10YR 6/2) very gravelly sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry and moist, nonsticky and nonplastic; few very fine roots; interstitial pores; moderately calcareous; lime is disseminated; lime coatings on gravel; moderately alkaline (pH 8.3).

The A horizon is very dark brown, dark-brown, or very dark grayish-brown gravelly fine sandy loam or cobbly fine sandy loam 7 to 15 inches thick. The B horizon is brown, dark-brown, or very dark grayish-brown to dark grayish-brown gravelly or very gravelly fine sandy loam or sandy loam that is 10 to 20 inches thick and 20 to 60 percent gravel. The A and B horizons are neutral to mildly alkaline. The C horizon is dark grayish-brown to light brownish-gray or brown to pale-brown very gravelly loamy sand or sand. The content of coarse fragments ranges from 50 to 90 percent. Reaction ranges from mildly alkaline to moderately alkaline. The lime content ranges from 15 to 20 percent.

Lakewin cobbly fine sandy loam, 15 to 30 percent slopes (LcE).--This soil occupies lake-terrace escarpments just above the flood plains, generally in long, narrow areas of medium size that are parallel to the stream. It has a cobbly surface layer and cobblestones throughout, but its profile is otherwise similar to the one described as typical for the series.

Included with this soil in mapping are some areas of Sterling soils and also small areas of soils having slopes of 6 to 15 percent.

This soil is well drained and is rapidly permeable. The available water capacity is about 3.5 inches to a depth of 5 feet. The erosion hazard is severe.

This soil is suited to range that is grazed in spring and in fall. Capability unit VIs-U4, nonirrigated.

Lakewin gravelly fine sandy loam, 1 to 6 percent slopes (LaC).--The profile of this soil is the one described as typical of the series.

Included with this soil in mapping are small areas of Bingham and Sterling soils and areas of a Lakewin cobbly fine sandy loam.

This soil is well drained and is rapidly permeable. The rooting depth is limited by large amounts of gravel and cobblestones below a depth of about 20 inches. This soil holds about 3.5 inches of water available to plants to a depth of 5 feet. Runoff is slow, and the erosion hazard is slight. The natural fertility is moderate.

Most of this soil is used for irrigated pear, cherry, peach, and apple orchards. Small grains, alfalfa, and pasture are also produced. In the

vicinity of Grandview, this soil is used for community development. Capability unit IVs-14, irrigated.

Lakewin gravelly fine sandy loam, 6 to 15 percent slopes (LaD).--This soil has a profile similar to that described as typical for the series, but its surface layer is 7 to 8 inches thick. This soil is in small, elongated areas that generally are on the west-facing slopes of lake-terrace escarpments. Most of the coarse fragments are the size of gravel, but some are the size of cobblestones.

Included with this soil in mapping are small areas of steeper soils.

This soil is well drained and rapidly permeable. The available water is about 3.5 inches to a depth of 5 feet. Runoff is medium, and the erosion hazard is moderate to severe.

This soil is used mainly for apple, pear, cherry, and peach orchards. In places it is used for range or pasture. Capability unit IVs-14, irrigated.

Layton Series

The Layton series consists of deep, well drained and moderately well drained soils on the outer edges or faces of lake terraces that are known locally as the Highland, Orem, and Mapleton Benches. Slopes range from 0 to 15 percent. These soils formed in wind worked, sandy, mixed lake sediments derived mainly from weathered sandstone and quartzite.

Elevations range from 4,500 to 5,200 feet. The average annual precipitation is about 16 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in summer if they are not irrigated. The mean annual soil temperature is 48° to 52° F., and the frost-free period is 130 to 170 days.

In a typical profile, the surface layer is dark-brown or very dark grayish-brown fine sandy loam 7 inches thick. Below this is brown or dark-brown, very friable loamy fine sand that extends to a depth of about 39 inches and is underlain by brown fine sand. A weak horizon of carbonate accumulation is at a depth of about 26 inches.

The vegetation consists mostly of bunchgrasses, cheatgrass, big sagebrush, and rabbitbrush.

The Layton soils are used for irrigated field crops and orchards and for community developments.

Representative profile of Layton fine sandy loam, 1 to 6 percent slopes, in an abandoned field 1/4 mile east of the Geneva Steel plant, at a point 1,320 feet south and 400 feet west of the center of section 4, T. 6 S., R. 2 E.:

A11--0 to 2 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, thick, platy structure that parts to weak, fine, granular; soft, very friable, nonsticky, and nonplastic; common fine and few medium roots; common, medium, and fine pores; noncalcareous; neutral (pH 7.2); abrupt, smooth boundary.

A12--2 to 7 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, moderate, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky, and slightly plastic; common fine roots; common fine pores; noncalcareous; mildly alkaline (pH 7.4); clear, smooth boundary.

AC--7 to 14 inches, brown (10YR 5/3) heavy loamy fine sand, dark brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; few fine roots; common, medium, discontinuous pores; noncalcareous; mildly alkaline (pH 7.5); gradual, wavy boundary.

C1--14 to 26 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; soft, very friable, nonsticky, and nonplastic; few, fine, and medium roots; common, medium, and fine pores; noncalcareous; mildly alkaline (pH 7.6); gradual, wavy boundary.

C2ca--26 to 39 inches, light-gray (10YR 7/2) loamy fine sand, brown (10YR 5/3) when moist; massive; slightly hard, very friable, nonsticky, and nonplastic; few fine roots; few large and common fine pores; moderately calcareous; lime is disseminated and is in fine soft splotches; moderately alkaline (pH 8.4); gradual, wavy boundary.

C3ca--39 to 57 inches, light-gray (10YR 7/2) fine sand, brown (10YR 5/3) when moist; massive; soft, very friable, nonsticky, and nonplastic; few medium and fine roots; few fine interstitial pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.3); gradual, wavy boundary.

The A1 horizon is brown or grayish-brown fine sandy loam or loamy fine sand 7 to 20 inches thick. The C horizon is dark grayish brown to light brown; it is typically loamy fine sand but ranges to loamy sand or fine sand. The Cca horizon is at a depth of 24 to 60 inches and is moderately calcareous. In places, strongly calcareous lake sediments occur below a depth of 3 feet. Reaction is mildly alkaline or moderately alkaline.

Layton fine sandy loam, 1 to 6 percent slopes (LfC).--A profile of this soil is the one described as typical of the series. The surface layer is 7 to 14 inches thick. Mottles occur below a depth of 40 inches in some places.

Included with this soil in mapping are small areas of a Kidman very fine sandy loam and small areas of Preston soils that are mainly fine sand. Other inclusions are small areas of soils having slopes of 0.5 to 1 percent. In some places, there are wind-blown hummocks as much as 3 feet high.

This soil is well drained and is rapidly permeable. It holds about 3.75 inches of water that is

available to plants. The rooting zone is deep. Runoff is slow the hazard of water erosion is slight and that of wind erosion is moderate. The natural fertility is low, but this soil is easy to work. The frost-free period is 150 to 170 days.

This soil is used for vineyards, for peach, cherry, apple, and pear orchards, and for alfalfa, small grains, and corn. Capability unit IIIs-14, irrigated.

Layton fine sandy loam, slowly permeable substratum, 0 to 1 percent slopes (LmA).--This soil occurs as large, broad areas on low lake terraces at slightly higher elevations than the adjacent moderately fine textured, somewhat poorly drained soils. It has a profile similar to that described as typical for the series, except that it has a moderately fine textured, slowly permeable substratum at a depth of 36 to 48 inches. Its surface layer is 14 to 20 inches thick. In places, there is weak lime cementation at the top of the moderately fine textured layers.

Included with this soil in mapping, near Camp Williams, is a small area of a soil that has slopes of about 1 to 1 1/2 percent.

This soil is moderately well drained, and the water table occurs between depths of 36 and 60 inches. The soil holds about 6 inches of available water. The frost-free period is 130 to 150 days.

This soil is used for alfalfa, small grains, sugar beets, corn, and pasture. Capability unit IIIs-26, irrigated.

Layton fine sandy loam, water table, 1 to 3 percent slopes (LnB).--This soil is on gently sloping, low lake terraces and occurs with somewhat poorly drained silty clay loams. Its profile is similar to that described as typical for the series, except its surface layer is 14 to 20 inches thick, and the water table is between depths of 36 and 60 inches (pl. II, top right).

Included with this soil in mapping are small areas that do not have a layer of lime within 60 inches of the surface.

This soil is moderately well drained and is moderately permeable. Natural fertility is moderate, and root penetration is generally deep. The frost-free period is 130 to 150 days.

This soil is used for irrigated corn, small grains, alfalfa, sugar beets, and pasture. Capability unit IIIs-26, irrigated.

Layton loamy fine sand, 6 to 15 percent slopes (LeD).--This soil is on terrace escarpments. It has a surface layer of loamy fine sand 12 to 20 inches thick, otherwise its profile is similar to the one described as typical for the series.

This soil is well drained and is rapidly permeable. It holds about 3 inches of water that is available to plants. Runoff is medium, and the erosion hazard is severe or very severe if the soil is left bare. Natural fertility is low. The frost-free season ranges from 150 to 170 days.

This soil is used mainly for peach, cherry, pear, and apple orchards, but some small areas are used for range. Capability unit IVs-14, irrigated.

Logan Series

The Logan series consists of deep, very poorly drained, nearly level, strongly calcareous soils. They are on the low lake terraces surrounding Utah Lake, mainly south of American Fork city. These soils are usually less than 25 feet above the water level of the lake. They formed in moderately fine textured, mixed, lake-laid sediments.

Elevations range from 4,450 to 4,515 feet. The average annual precipitation is 12 to 14 inches. The mean annual soil temperature is 49° or 50° F., and the frost-free period is 130 to 150 days.

In a typical profile, a layer of peat 8 inches thick is over a layer of black silty clay loam 13 inches thick. Below this layer is about 23 inches of gray and light-gray firm, silty clay loam. At a depth of about 36 inches is stratified light-gray light silt loam and silty clay. Common, medium, distinct, dark-brown mottles occur throughout the profile and strong accumulations of carbonate are within 16 inches of the surface.

The vegetation consists mainly of sedges, wiregrass, tules, and cattails.

The Logan soils are used for wet meadow pasture and as wildlife habitat. A small acreage has been drained and is used for irrigated crops.

Representative profile of Logan silty clay loam in a native meadow pasture 3 miles southwest of American Fork city, at a point 1,320 feet north and 1,450 feet west of the SE. corner of section 27, T. 5 S., R. 1 E.:

02--8 inches to 0, fibrous peat; noncalcareous, clear, smooth boundary.

A11g--0 to 9 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; few, medium, distinct, yellowish-red (5YR 4/6) mottles; weak, medium to fine, subangular blocky structure; hard, firm, sticky, and very plastic; many medium and fine roots; common medium and fine pores; slightly calcareous; neutral (pH 6.9); abrupt, smooth boundary.

A12g--9 to 13 inches, very dark grayish-brown (2.5Y 3/2) heavy silty clay loam and peat, black (N 2/0) when moist; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure that parts to moderate, fine, granular; common fine pores; slightly calcareous; neutral (pH 7.0); clear, smooth boundary.

C1cag--13 to 17 inches, gray (5Y 5/1) silty clay loam, black (2.5Y 2/1) when moist; common, medium, distinct yellowish-red (5YR 4/6) mottles; massive; hard, firm, slightly sticky, and plastic; few fine roots; common medium and few fine pores; strongly calcareous;

lime is disseminated; mildly alkaline (pH 7.5); gradual, wavy boundary.

C2cag--17 to 28 inches, gray (2.5Y 6/1) silty clay loam, dark gray (5Y 4/1) when moist; common, medium, distinct, dark-brown (7.5YR 4/4) mottles; massive; hard, firm, slightly sticky, and plastic; few medium and few fine roots; common large pores and few medium and fine pores; very strongly calcareous; lime is disseminated; mildly alkaline (pH 7.5); clear, smooth boundary.

C3cag--28 to 36 inches, light-gray (5Y 7/1) silty clay loam, gray (5Y 5/1) when moist; common, medium, faint, olive (5Y 5/5) mottles; massive; hard, firm, slightly sticky, and plastic; common medium and fine pores; very strongly calcareous; mildly alkaline (pH 7.6); gradual, wavy boundary.

C4cag--36 to 56 inches, light-gray (2.5Y 7/1) light silt loam, gray (5Y 5/1) when moist; common, medium, faint-gray (5Y 6/1) mottles; massive; slightly hard, friable, nonsticky, and slightly plastic; few medium and common fine pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.5); gradual, wavy boundary.

C5g--56 to 77 inches, light-gray (5Y 7/1) silty clay, dark gray (N 4/0) when moist; massive; very hard, very firm, sticky, and plastic; strongly calcareous; lime is disseminated; neutral (pH 7.3).

There are layers of peat 5 to 12 inches thick on the surface in places, but these layers may also occur as buried horizons in the profile. The A horizon is very dark gray or black, is 10 to 20 inches thick, and ranges from noncalcareous to strongly calcareous. The Cca horizon is black, dark gray, or gray and is strongly calcareous or very strongly calcareous. The lower C horizon is similar to the upper C horizon in color, but it is stratified silty clay to light silt loam. Reaction is neutral or mildly alkaline.

Logan silty clay loam (0 to 1 percent slopes) (Lo).--A profile of this soil is described as typical of the series. The texture is typically silty clay loam below the surface layer, but in some places it is silty clay to silt loam. In places there are layers of peat below the surface layer that are generally less than 5 inches thick. The layers containing large amounts of lime range from a few inches to about 3 feet in thickness, and they may occur at any depth.

Included with this soil in mapping are areas of Ironton loam and of Chipman silty clay loam. Also included are areas that have more than 12 inches of peat on the surface. South of the Lehi sugar factory there also is an area of about 100 acres that has 4 to 18 inches of overwash limy waste material from the factory.

This Logan soil is very poorly drained. Mottling in the surface layer is typical. The water table is at or near the surface early in spring and in summer. Permeability is slow. Root penetration is usually restricted by the high water table. If drained, this soil holds about 11 inches of available water. Surface runoff is very slow or ponded, and there is no erosion hazard. The natural fertility is very high.

This soil is used as wildlife habitat and for pasture. A few small areas have been drained and reclaimed and are used for small grains and pasture. Capability unit IVw-25, irrigated.

Logan Series, Heavy Variant 3/

The Logan series, heavy variant, consists of deep, poorly drained, strongly calcareous, nearly level soils. These soils are on low lake terraces. They formed in fine-textured, mixed lake sediments.

Elevations range from 4,490 to 4,515 feet. The average annual precipitation is 12 to 14 inches. The mean annual soil temperature is 49° or 50° F., and the frost-free period is 130 to 150 days.

In a typical profile, the surface layer is black, noncalcareous, very firm silty clay loam about 20 inches thick. Below this is very dark-gray, strongly calcareous silty clay. The substratum is gray, massive, strongly calcareous, firm silty clay loam. Distinct mottles occur below a depth of 10 inches.

The vegetation is mainly saltgrass, bassia, and kochia.

These Logan soils are not extensive in this survey area. They are used for meadow pasture.

Logan silty clay loam, heavy variant (0 to 1 percent slopes) (Ls).--This soil is mainly east of the Jordan River between the Lehi pumping plant and State Road 73, but it also occurs south of Lincoln Beach near the Benjamin Slough. The organic-matter content is more than 1.5 percent throughout the profile. Depth to the water table ranges from 20 to 40 inches.

This soil is nearly level, poorly drained, and slowly permeable. Roots penetrate to a depth of 5 feet but are restricted by the water table. If drained, this soil holds 11 inches of water, but the salt content reduces the amount of water available to plants to 9 inches. Runoff is very slow to ponded. There is no erosion hazard except deposition during periods of flooding. Natural fertility is very high, but because of the saline surface layer, the vegetation is saltgrass, bassia, kochia, and other salt-tolerant plants.

This soil is used for pasture. Capability unit IVw-25, irrigated.

3/ These heavy variant soils from this series have now been correlated as Magna soils. More extensive areas of these soils were found around Salt Lake and East Box Elder since the soils in this survey area were mapped.

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Manila Series

The Manila series consists of deep, well-drained, slightly acid or neutral soils on fans and mountain slopes, mainly south of Payson and in Pole Canyon. Slopes range from 10 to 30 percent. These soils formed in medium or moderately fine textured alluvium and colluvium from weathered sedimentary rocks.

Elevations range from 5,135 to 6,000 feet. The average annual precipitation is 18 to 25 inches. These soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in summer. The mean annual temperature ranges from 44° to 47° F., and the frost-free period is 80 to 100 days.

In a typical profile, the surface layer is very dark-brown, neutral silt loam about 6 inches thick. The subsoil is dark brown, neutral, and very firm or firm. It is clay loam in the uppermost 11 inches, silty clay in the middle 25 inches, and dark-brown cobbly clay loam in the lowermost 20 inches. Below this is dark-brown cobbly loam.

The vegetation is big sagebrush, western wheatgrass, bluebunch wheatgrass, maple, and brushy Gambel oak.

The Manila soils are not extensive in this survey area. They are used for range, as wildlife habitat, and for watersheds.

Representative profile of Manila silt loam, 10 to 30 percent slopes, in a range area 2 1/2 miles southeast of the town of Salem, at a point 1,600 feet west of the east corner of section 18 and of 19, T. 9 S., R. 3 E.:

A1--0 to 6 inches, brown (10YR 5/3) silt loam, very dark brown (10YR 2/2) when moist; weak, thin, platy structure; slightly hard, friable, slightly sticky, and plastic; common fine and very fine roots; many fine pores; neutral (pH 6.9); clear, smooth boundary.

B1--6 to 17 inches, brown (10YR 5/3) clay loam, dark brown (7.5YR 3/3) when moist; strong, fine, angular blocky structure; very hard, firm, sticky, and very plastic; common fine and few very fine roots; few fine and very fine pores; thin, patchy clay films; neutral (pH 6.8); gradual, smooth boundary.

B2t--17 to 42 inches, brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/6) when moist; moderate, medium, prismatic structure that parts to strong, coarse, angular blocky; extremely hard, very firm, very sticky, and very plastic; few large roots and few fine and very fine roots; few fine and very fine pores; moderately thick, continuous clay films; neutral (pH 6.5); gradual, wavy boundary.

B3--42 to 63 inches, light-brown (7.5YR 6/4) cobbly clay loam, dark brown (7.5YR 4/4) when moist; moderate, medium, angular blocky structure; very hard, firm, sticky, and very plastic; few fine roots; few fine pores; moderately thick, continuous, and thick, patchy clay films; neutral (pH 6.9); gradual, wavy boundary.

C--63 to 73 inches, light-brown (7.5YR 6/4) cobbly loam, dark brown (7.5YR 4/4) when moist; massive; very hard, firm, sticky, and very plastic; few very fine roots; common very fine pores; few patchy clay films; neutral (pH 7.2); abrupt, smooth boundary.

The A horizon is very dark brown to very dark grayish brown and ranges from 6 to 18 inches in thickness. The B2t horizon is dark-brown to brown or dark reddish-brown to reddish-brown heavy silty clay loam to clay and is more than 35 percent clay. Coarse fragments range from 5 to 20 percent to a depth of 40 inches and from 5 to 50 percent below 40 inches. The B3 horizon is dark-brown or brown silty clay loam or clay loam. Strongly calcareous layers occur below a depth of 73 inches in most areas. The organic-matter content decreases regularly with depth and is less than 0.5 percent to a depth of 50 inches below the surface.

Manila silt loam, 10 to 30 percent slopes (MAF).--A profile of this soil is described as typical of the series. The dark-colored surface layer and upper subsoil are 10 to 20 inches thick and contains scattered gravel and cobblestones. Below a depth of 40 inches, the soil mass is generally 20 to 50 percent cobblestones. The depth to the calcareous layer is 6 to 8 feet.

Included with this soil in mapping are severely eroded areas that lack all or nearly all of the surface layer and commonly have large vertical cracks when the soil is dry. Mulesear dock and slender wheatgrass are the principal plants in the eroded areas. Also included are small areas of Henefer soils that are cobbly or gravelly and some areas that have a dark-colored surface layer and upper subsoil more than 20 inches thick. Some soils having slopes of 6 to 10 percent are also included in places.

This Manila soil is well drained. The rooting zone is deep. The soil holds about 11 inches of available water. Runoff is medium, and the erosion hazard is moderate. Permeability is slow. The natural fertility is moderate.

This soil is grazed by livestock in spring and in fall and by deer in winter. Capability unit VIe-M, nonirrigated.

Martini Series

The Martini series consists of deep, moderately well drained, stratified, calcareous, nearly level soils that are underlain by sand or gravel in places. These soils are on flood plains and alluvial fans near Lehi city and the town of Lake Shore. They developed in mixed alluvium from weathered quartzite, sandstone, limestone, and granite.

Elevations range from 4,490 to 4,590 feet. The average annual precipitation is about 14 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more

than 60 consecutive days in summer. The mean annual soil temperature is more than 47° F. The frost-free period ranges from 130 to 150 days.

In a typical profile, the surface layer is very dark grayish-brown, mildly alkaline, fine sandy loam 12 inches thick. Below this is dark-brown, mildly alkaline, fine sandy loam and light sandy loam about 38 inches thick. Below a depth of 50 inches is brown loamy fine sand.

The vegetation consists of sagebrush, willow, cheatgrass, cottonwood, wild rose, and annual weeds.

Martini soils are not extensive in this survey area. They are used for irrigated crops.

Representative profile of Martini fine sandy loam in a cultivated field 1/8 mile southwest of the Lehi city cemetery, at a point 1,320 feet west and 500 feet north of the center of section 9, T. 5 S., R. 1 E.:

Ap--0 to 9 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard, friable, nonsticky, and slightly plastic; common fine and very fine roots; few fine and very fine pores; moderately calcareous, lime is disseminated; mildly alkaline (pH 7.5); abrupt, smooth boundary.

A1--9 to 12 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, platy structure that parts to weak, fine, granular; hard, friable, nonsticky, and slightly plastic; few fine roots; few fine discontinuous pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.6); clear, smooth boundary.

C1--12 to 17 inches, pale-brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky, and nonplastic; few very fine roots and pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.7); clear, smooth boundary.

C2--17 to 50 inches, pale-brown (10YR 6/3) light sandy loam, dark brown (10YR 4/3) when moist; few, medium, distinct, dark yellowish-brown (10YR 4/4) mottles at a depth of 25 inches; massive; soft, very friable, nonsticky, and nonplastic; few very fine roots; few medium and fine pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.7); abrupt, wavy boundary.

C3--50 to 60 inches, very pale-brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) when moist; massive; soft, very friable, nonsticky, and nonplastic; few very fine roots; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.7); abrupt, wavy boundary.

The depth to the water table ranges from 40 to 60 inches. Distinct mottles occur at some depth between 20 and 40 inches. Salinity ranges from none to slight. At a depth between 10 and 40 inches, colors are dark brown or brown. The texture ranges from fine sandy loam to heavy loamy fine sand, but it is generally fine sandy loam.

Martini fine sandy loam (0 to 1 percent slopes) (Mf).--A profile of this soil is the one described as typical for the series. The surface layer ranges from 7 to 12 inches in thickness. In places sand or gravel is at a depth of 20 to 30 inches. Depth to the water table ranges from 40 to 60 inches. Distinct mottles occur at some depth between 20 and 40 inches.

Included with this soil in mapping are small areas of soils that are mottled above a depth of 20 inches and small spots of strongly saline-alkali soils. Two miles west and 1/2 mile south of the town of Lakeshore, are about 50 acres of a soil that has a loam surface layer 8 to 15 inches thick. Also included in the mapping are a few small areas of Sunset loam.

This soil is easy to work, and it absorbs moisture readily. It is moderately well drained and is rapidly permeable. Roots penetrate deep, except where they are restricted by the water table. This soil holds about 7 inches of available water. Runoff is slow, and water erosion is not a hazard. The natural fertility is moderate.

This soil is used mainly for growing irrigated alfalfa, corn, small grains, sugar beets, and pasture. Capability unit IIw-2, irrigated.

McBeth Series

The McBeth series consists of deep, strongly calcareous, poorly drained, nearly level soils on flood plains and thin alluvial fans deposited over low lake terraces. These soils occur mainly south and west of the city of Pleasant Grove and west of Springville city. They formed in mixed, medium-textured alluvium from weathered limestone, sandstone, and quartzite.

Elevations range from 4,490 to 4,600 feet. The average annual precipitation is 12 to 16 inches. The mean annual soil temperature is 48° to 52° F., and the frost-free period is 130 to 150 days.

In a typical profile, the surface layer is very dark-gray silt loam 12 inches thick. The next layer is dark-gray, mottled, friable or very friable, stratified silt loam to very fine sandy loam. Below this is stratified silty clay loam to sandy loam. The water table is between a depth of 20 and 50 inches in undrained areas.

The vegetation consists mainly of sedge, wiregrass, and tule.

The McBeth soils are used for irrigated crops and for pasture.

Representative profile of McBeth silt loam in a cultivated field about 1 mile southeast of American Fork city, at a point 800 feet south and 50 feet west of the NE. corner of section 25, T. 5 S., R. 1 E.:

Ap--0 to 8 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; moderate, medium, granular structure; hard, friable,

slightly sticky, and plastic; few fine and few medium roots; few fine and few medium pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.

A1--8 to 12 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; moderate, fine, blocky structure; hard, friable, slightly sticky, and plastic; few fine and few medium roots; few fine and few medium pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.

C1g--12 to 18 inches, gray (10YR 5/1) silt loam, dark gray (10YR 4/1) when moist; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; weak, medium, subangular blocky structure; hard, friable, slightly sticky, and plastic; few fine roots; few fine and few medium pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.9); abrupt, smooth boundary.

C2g--18 to 24 inches, gray (10YR 5/1) very fine sandy loam, dark gray (2.5Y 4/1) when moist; massive; hard, very friable, nonsticky, and slightly plastic; few fine roots; few, fine, interstitial pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.0); gradual, wavy boundary.

C3g--24 to 53 inches, gray (10YR 6/1) light silt loam, dark gray (10YR 4/1) when moist; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; slightly hard, very friable, slightly sticky, and plastic; few fine roots; common medium and few fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.9); clear, smooth boundary.

C4g--53 to 68 inches, grayish-brown (10YR 5/2) light silt loam, dark gray (10YR 4/1) when moist; few, fine, faint, dark yellowish-brown (10YR 4/4) mottles; massive; slightly hard, friable, slightly sticky, and plastic; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.8).

The A horizon ranges from black to very dark gray if it is not mottled; if mottled, it ranges from very dark brown to very dark grayish brown. The C horizon has similar colors, but they range to dark gray if not mottled and to dark grayish brown if mottled. The texture, to a depth of about 40 inches, is very fine sandy loam or silt loam that has less than 18 percent clay and less than 15 percent fine sand or coarser. Below a depth of 40 inches is silty clay loam to sandy loam. The soil is nonsaline to strongly saline, and reaction ranges from moderately to strongly alkaline. The lime content ranges from 20 to 40 percent.

McBeth silt loam (0 to 1 percent slopes) (Mh).--A profile of this soil is the one described as typical of the series.

Included with this soil in mapping are small areas of Chipman silty clay loam and small saline spots. West of Lindon there are small areas of soils that have a distinct olive color. Small streaks of gravel no more than a few feet wide are in some places.

This soil is poorly drained. The water table is at a depth of 20 to 50 inches and is highest in spring and early in summer. Permeability is moderately rapid. Roots penetrate to the level of the water table. If drained, the soil holds about 11 inches of available water. Surface runoff is very slow, and there is no erosion hazard. The natural fertility is very high.

If drained, this soil is well suited to alfalfa, small grains, and pasture, and to sugar beets, potatoes, corn, and other vegetable crops. Capability unit IIw-2, irrigated.

McBeth silt loam, moderately saline (0 to 1 percent slopes) (Mn).--This soil is moderately saline, otherwise its profile is similar to that described as typical for the series.

This soil is poorly drained. Depth to the water table ranges from 20 to 50 inches. Permeability is moderately rapid. It holds about 11 inches of water to a depth of 5 feet, but the salt content reduces the amount of water available to plants to about 8 inches. Runoff is very slow, and the erosion hazard is none to slight.

This soil is used mainly for meadow pasture, but barley and alfalfa are grown in some places. When drained and reclaimed, it is suited to sugar beets, alfalfa, small grains, and pasture. Capability unit IIIw-27, irrigated.

McMurdie Series

The McMurdie series consists of deep, well-drained soils on terraces of the Alpine level of ancient Lake Bonneville. Slopes range from 3 to 10 percent. These soils occur mainly east of the town of Lindon and north of the power plant east of Spanish Fork city. They formed in mixed, fine-textured lake sediments derived mainly from weathered shale and limestone.

Elevations range from 4,800 to 5,050 feet. The average annual precipitation is 16 to 20 inches. These soils are usually moist, but they are dry in all parts at depths of 7 to 20 inches for more than 60 consecutive days in the summer unless they are irrigated. The average annual temperature is 48° to 52° F. The average summer temperature is 64° to 74° F., and the frost-free period is 150 to 170 days.

In a typical profile, the surface layer is very dark grayish-brown, neutral silt loam about 7 inches thick. The subsoil is dark-brown, mildly alkaline, firm, silt loam and silty clay about 28 inches thick. The substratum is brown, firm, moderately or strongly calcareous, silty clay and silty clay loam.

The vegetation consists of brushy Gambel oak, big sagebrush, and wheatgrass.

The McMurdie soils are used for dryland farming.

Representative profile of an eroded McMurdie silt loam having slopes of 6 to 10 percent, in a nonirrigated wheat field about 1 mile east of the town of Lindon, 1,000 feet south and 900 feet west of the NE. corner of section 34, T. 5 S., R. 2 E.:

Ap--0 to 7 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium to coarse, subangular blocky structure that parts to moderate, fine, granular; hard, firm, sticky, and plastic; common fine and few medium roots; common fine and few medium pores; neutral (pH 7.2); abrupt, smooth boundary.

B1--7 to 11 inches, grayish-brown (10YR 5/2) silt loam, dark brown (10YR 3/3) when moist; moderate, coarse and medium, angular blocky structure; hard, firm, sticky, and plastic; few fine roots; common fine and few medium pores; common thin clay films; noncalcareous; mildly alkaline (pH 7.4); clear, smooth boundary.

B2t--11 to 25 inches, grayish-brown (10YR 5/2) silty clay, dark brown (7.5YR 3/2) when moist; strong, medium, prismatic structure that parts to strong, coarse and medium, angular blocky; very hard, firm, sticky, and very plastic; few fine roots; common fine pores; continuous, moderately thick clay films; noncalcareous; mildly alkaline (pH 7.5); gradual, wavy boundary.

B3ca--25 to 35 inches, brown (7.5YR 5/3) silty clay, brown (7.5YR 4/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky; very hard, firm, sticky, and very plastic; few fine roots; common fine pores; common moderately thick clay films; moderately calcareous; lime is in soft nodules inside the peds; moderately alkaline (pH 8.0); gradual, wavy boundary.

C1ca--35 to 47 inches, pale-brown (10YR 6/3) silty clay, brown (7.5YR 4/3) when moist; weak, medium, prismatic structure; very hard, firm, sticky, and very plastic; few fine roots; few fine pores; few, moderately thick clay films; moderately calcareous; lime is in soft nodules inside the peds; moderately alkaline (pH 8.1); gradual, wavy boundary.

C2ca--47 to 63 inches, light yellowish-brown (10YR 6/4) silty clay loam, brown (10YR 4/3) when moist; massive; hard, firm, sticky, and very plastic; common fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.9).

The solum is 24 to 40 inches thick. Depth to the Cca horizon is 25 to 60 inches. The A1 horizon is dark brown to very dark grayish brown and is 7 to 10 inches thick. The B2t horizon is very dark grayish brown to dark grayish brown or dark brown to brown silty clay to clay. The B3ca horizon is dark brown to brown or very dark grayish brown to dark grayish brown and is moderately calcareous to strongly calcareous. The Cca horizon is dark brown to brown; the lime content ranges from 16 to 49 percent but is generally about 20 percent. Texture of the Cca horizon is mainly silty clay but there are layers of silty clay loam. Reaction is neutral or mildly alkaline in the A, B1, and B2t horizons.

McMurdie silt loam, 3 to 6 percent slopes (MrC).--This gently rolling soil occurs on broad lake terraces east of the town of Lindon and on the Mapleton Bench north of the powder plant east of Spanish Fork city. This soil is not eroded, otherwise its profile is similar to that described as typical for the series.

Included with this soil in mapping, on the steeper slopes, are small areas of a Parleys silty clay loam. Below a landslide area 2 miles northeast of Pleasant Grove city there is also an irrigated field of dark gray, moderately calcareous clay loam overwash 6 to 8 inches thick.

This McMurdie soil is well drained and moderately slowly permeable. The available water is about 11 inches to a depth of 5 feet. Runoff is medium, and the erosion hazard is moderate. The natural fertility is medium.

Most of this soil is cultivated. It is used mainly for dryland wheat, pasture, and alfalfa. A few small fields are irrigated and are used for alfalfa, small grains, and apples. Capability unit IIIe-U, nonirrigated.

McMurdie-Taylorsville complex, 6 to 20 percent slopes, eroded (MtE2).--About 50 percent of this mapping unit is McMurdie silt loam, 6 to 10 percent slopes, eroded, and the rest is Taylorsville silty clay loam, 6 to 20 percent slopes, eroded. The McMurdie soil is in the smoother, low areas, and the Taylorsville soil is on the ridges (pl.III, bottom). This McMurdie soil has the profile described as typical of the McMurdie series. The Taylorsville soil is eroded, otherwise its profile is similar to that described as typical for the Taylorsville series.

Runoff is rapid from the McMurdie soil and the Taylorsville soil, and the erosion hazard is severe. The McMurdie soil is well drained and is moderately slowly permeable. Rooting depth is restricted by clayey, platy lake sediments in the lower part of the profile. The soil holds 11 inches of available water to a depth of 5 feet. The natural fertility is medium.

In places, especially on the ridges, erosion has removed much of the surface layer from the Taylorsville soil, and the whitish, calcareous subsoil material is exposed. Shallow gullies have formed in the bottom of drainageways, and sheet erosion, including a few rills, is active on the unprotected slopes.

The McMurdie soil is used for dryland alfalfa and wheat. The McMurdie soil is in capability unit IIIe-U, nonirrigated; the Taylorsville soil is in capability unit VIe-U, nonirrigated.

McPhie Series

The McPhie series consists of deep, well-drained soils on the north-facing slopes of the Traverse Mountain. Slopes are 5 to 60 percent. These soils formed in mixed alluvium and colluvium from weathered granite and intermediate igneous rocks.

Elevations range from 5,500 to 7,000 feet. The average annual precipitation is 20 to 25 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for 60 consecutive days in summer. The mean annual soil temperature is less than 47° F. The mean summer temperature is 60° to 65° F., and the frost-free period is 80 to 90 days.

In a typical profile, the surface layer is very dark-brown, slightly acid sandy loam or light loam about 12 inches thick. The subsurface layer is dark grayish-brown, slightly acid, gravelly sandy loam about 12 inches thick. The subsoil is dark-brown, medium acid, firm, cobbly sandy loam and cobbly light loam to a depth of more than 50 inches.

The vegetation is brushy Gambel oak, maple, peavine, and scattered aspen and conifers.

McPhie soils are used for grazing.

Representative profile of a McPhie sandy loam on slopes of 5 to 30 percent, in a grazed area in Fort Canyon, about 1/2 mile west of the last farmhouse, at a point, 3,000 feet west and 1,600 feet south of the NE. corner of section 12, T. 4 S., R. 1 E.:

A11--0 to 7 inches, very dark grayish-brown (10YR 3/2) sandy loam, very dark brown (10YR 2/2) when moist; moderate, coarse, subangular blocky structure that parts to moderate, coarse, granular; slightly hard, friable, nonsticky, and nonplastic; common fine and medium and few large roots; few, fine, medium and large pores; slightly acid (pH 6.1); clear, smooth boundary.

A12--7 to 12 inches, dark grayish-brown (10YR 4/2) light loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, subangular blocky structure that parts to weak, medium, granular; slightly hard, friable, nonsticky, and slightly plastic; common medium and few fine and large roots; few fine and medium pores; strongly acid (pH 5.5); clear, wavy boundary.

A2--12 to 24 inches, grayish-brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky, and slightly plastic; clean sand grains; many large, common medium, and few fine roots; many fine, common medium and large pores; slightly acid (pH 6.2); gradual, wavy boundary.

B&A--24 to 30 inches, brown (10YR 5/3) cobbly sandy loam, dark brown (10YR 4/3) when moist; the A horizon has ped coatings of pale brown (10YR 6/3) and dark brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; hard, firm, sticky, and plastic; few fine and medium roots; few fine pores; common thin clay films in pores; clean sand or silt grains; medium acid (pH 6.0); gradual, wavy boundary.

B21t--30 to 38 inches, brown (10YR 5/3) cobbly light loam, dark brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; hard, firm, sticky, and plastic; few fine and medium roots; few fine pores; common thin clay films, mainly in pores; medium acid (pH 5.8); gradual, wavy boundary.

B22t--38 to 55 inches, brown (10YR 5/3) cobbly light loam, dark brown (10YR 4/3) when moist; moderate, coarse, subangular blocky structure that parts to medium and fine, subangular blocky; hard, firm, sticky, and plastic; few fine and medium roots; few medium and fine pores; common moderately thick clay films, mainly in pores; medium acid (pH 5.9); gradual, wavy boundary.

B3--55 to 60 inches, brown (7.5YR 5/4) cobbly sandy loam, dark brown (7.5YR 3/3) when moist; massive; hard, firm, sticky, and plastic; few medium roots; few fine pores; common thick and few moderately thick clay films; neutral (pH 6.6).

The solum is more than 4 feet thick. The A1 horizon is very dark brown to very dark grayish-brown sandy loam or gravelly sandy loam. The A2 horizon is dark grayish-brown to dark-brown gravelly sandy loam and is 20 to 50 percent angular gravel and cobblestones. The B2t horizon is dark-brown or brown to dark yellowish-brown cobbly loam to gravelly fine sandy loam that contains less than 18 percent clay and more than 15 percent sand coarser than very fine sand; coarse fragments range from 20 to 50 percent. Reaction ranges from slightly to strongly acid. The B3 horizon is brown to pale brown or light brown and is slightly acid to neutral. It ranges from cobbly loam to cobbly sandy loam and is 30 to 50 percent angular gravel and cobblestones.

Mixed Alluvial Land

Mixed alluvial land (MU) occurs near stream channels or in delta areas where streams enter Utah Lake. It occupies some fairly large areas along the Jordan River and in Provo Bay near the mouth of the Spanish Fork River. In places it is inundated for 2 months or more.

The soil material is stratified and ranges from sandy to clayey. Generally the layers of different soil material range from 3 to 12 inches in thickness, but they are as much as 36 inches thick in places (pl. III, top left). Boundaries between the layers are commonly abrupt. Distinct mottles above 20 inches occur in places; generally they are between a depth of 20 and 40 inches.

The water table fluctuates between depths of 0 and 60 inches. The salt and alkali content ranges from slight to strong, but it is typically moderate.

Gravel and cobblestones occur in places, but they generally make up less than 20 percent of the material.

The vegetation consists mainly of annual weeds, saltgrass, tamarisk, willows, and cottonwoods.

This land is used for pasture and rather extensively as a habitat for wildlife. Capability unit VIw-25, nonirrigated.

Mixed alluvial land, saline (MX) occurs near the area where the Spanish Fork River empties into Utah Lake and in areas along the Jordan River, north of the pumping plant. It is similar to Mixed alluvial land, except it is strongly or very strongly saline-alkali.

Most areas are bare or have only a sparse cover of greasewood, pickleweed, or tamarisk.

This land has only limited use as wildlife habitat. Capability unit VIIIw-8, nonirrigated.

Parleys Series

The Parleys series consists of deep, well-drained soils on lake terraces on the Highland, Orem, Mapleton, and South Payson Benches. Slopes range from 0 to 6 percent. These soils developed in lake sediments derived from quartzite, granite, and limestone.

Elevations range from 4,640 to 5,135 feet. The average annual precipitation is 15 to 20 inches. The soils are usually moist, but they are dry in all parts at a depth of 7 to 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 48° to 52° F. The frost-free period is 150 to 170 days.

In a typical profile, the surface layer is very dark-brown, neutral loam about 7 inches thick. The subsoil is dark-brown, mildly alkaline, very firm silty clay loam about 28 inches thick. The substratum is brown, mildly to moderately alkaline, strongly calcareous, friable to firm heavy silt loam.

Most of the Parleys soils that are irrigated with water from the Strawberry irrigation system have a calcareous surface layer and subsoil. Water from this system carries large amounts of calcareous fine sediments at times.

The vegetation consists of big sagebrush, Gambel oak, bluebunch wheatgrass, and western wheatgrass.

Parleys soils are used for irrigated alfalfa, small grains, corn, sugar beets, pasture, and orchards. They are also used for dryland wheat and alfalfa.

Representative profile of Parleys loam, 0 to 3 percent slopes, in a cultivated field 1 1/2 miles west of the town of Alpine, at a point 2,000 feet south and 600 feet west of the NE. corner of section 26, T. 4 S., R. 1 E.:

Ap--0 to 7 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure that parts to weak, fine, granular; hard, friable, slightly sticky, and plastic; common medium and fine roots; common fine pores; neutral (pH 7.2); abrupt, smooth boundary.

B2t--7 to 20 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; moderate, medium to coarse, prismatic structure that parts to strong, medium, angular blocky; very hard, very firm, sticky, and very plastic; common fine roots; few large and medium pores; continuous, thin, and few moderately thick clay films; mildly alkaline (pH 7.4); clear, smooth boundary.

B3ca--20 to 35 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) when moist; moderate, medium, and fine prismatic structure that parts to moderate, medium, and fine, angular blocky; hard, firm, sticky, and very plastic; few fine roots; common fine pores; moderately calcareous; lime is disseminated; thin, continuous clay films; moderately alkaline (pH 7.9); gradual, wavy boundary.

C1ca--35 to 51 inches, pale-brown (10YR 6/3) heavy silt loam, brown (10YR 4/3) when moist; massive; hard, firm, sticky, and plastic; few very fine roots; common fine and few medium pores; moderately calcareous; lime is disseminated and is in small nodules; mildly alkaline (pH 7.8); clear, smooth boundary.

C2--51 to 67 inches, pale-brown (10YR 6/3) heavy silt loam, brown (10YR 4/3) when moist; massive; hard, friable, slightly sticky, and plastic; few very fine roots; common fine and few medium pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.0).

The A horizon is very dark brown to very dark grayish brown or dark brown. The B horizon ranges from 18 to 30 inches in thickness and from dark brown to very dark grayish brown or dark grayish brown. The B horizon is neutral to mildly alkaline silty clay loam or clay loam that contains 27 to 35 percent clay and less than 15 percent very fine or coarser sand. The C horizon is light grayish-brown or grayish-brown to brown clay loam to silty loam. The lime content of the strong lime horizon ranges from 20 to 45 percent.

Parleys gravelly loam, overwashed, 3 to 6 percent slopes (PbC).--This soil occurs as fairly broad areas on west-facing slopes of lake terraces. This soil has been overwashed by calcareous gravelly loam, otherwise its profile is similar to the one described as typical for the Parleys series. The overwash material is 8 to 22 inches thick and contains 25 to 40 percent gravel. The subsoil is calcareous because lime has been leached from the upper horizons.

Included with this soil in mapping are about 15 acres of soils having slopes of 6 to 10 percent. Also included are small areas of soils that lack the overwash material.

This soil is well drained and is moderately slowly permeable. It holds about 10 inches of available water. Runoff is medium, and the erosion

hazard is moderate. The natural fertility is moderate.

This soil is used for peach, cherry, pear, and apple orchards. Alfalfa, pasture, and small grains are also grown. Capability unit IIIe-1, irrigated.

Parleys loam, 0 to 3 percent slopes (PaB).--A profile of this soil is the one described as typical of the series. The surface layer ranges from 7 to 12 inches in thickness, and the texture is mainly loam but ranges to fine sandy loam or silt loam. The surface layer and subsoil are slightly calcareous and mottled in places.

This soil is well drained and is moderately slowly permeable. Roots penetrate to a depth of 5 feet or more. The soil holds about 12 inches of available water. Surface runoff is slow, and erosion is only a slight hazard. Natural fertility is high. This soil is friable and easy to work.

Included with this soil in mapping are small areas of a Parleys soil that has a slope of more than 3 percent and small areas of Timpanogos soils that have a heavy loam subsoil. Also included are small, widely scattered areas that have gravel at a depth of more than 24 to 36 inches. These areas occur mainly on the Highland Bench and on the bench south and west of the Spanish Fork power plant.

North of the pea vinery in Mapleton is a small area of this soil that is mottled at depths between 20 and 40 inches, and the water table is not within 6 feet of the surface.

Most of this soil is used for irrigated crops of alfalfa, small grains, corn, pasture, sugar beets, and peach, cherry, apple, and pear orchards (pl. IV, bottom). Capability units I-1, irrigated, and IIIe-U, nonirrigated.

Parleys loam, 3 to 6 percent slopes (PaC).--This soil has a profile similar to that described as typical for the series. The surface layer ranges from 5 to 8 inches in thickness.

This soil is well drained and is moderately slowly permeable. Roots penetrate to a depth of 5 feet or more. This soil holds about 12 inches of available water. Runoff is medium, and water erosion is a moderate hazard.

Included with this soil in mapping are small areas of a Parleys soil on slopes of 0 to 3 percent and small areas of Timpanogos soils. Also included, in places, are soils that have slopes of 6 to 10 percent and have a severe erosion hazard.

This soil is used for irrigated crops of alfalfa, small grains, pasture, and peach, cherry, pear, and apple orchards (pl. V, top). Small areas are also used for nonirrigated wheat, alfalfa, or pasture. Capability unit IIe-1, irrigated, and IIIe-U, nonirrigated.

Parleys silty clay loam, 0 to 3 percent slopes (PcB).--This soil is mainly on the Orem and Mapleton Benches. It has a surface layer of silty clay loam and a subsoil of heavy silty clay loam, but its profile is otherwise similar to that described as typical for the series.

Included with this soil in mapping are some small areas of a Parleys loam and some areas of soils that have slopes of 3 to 6 percent. About 1/2 mile north of the power plant, at the mouth of the Spanish Fork Canyon, are areas of a soil that is gravelly at a depth between 24 and 36 inches. South of Santaquin city, there is a small acreage that has a reddish-brown surface layer.

This Parleys soil is well drained and is moderately slowly permeable. The available water is about 12 inches to a depth of 5 feet. Runoff is slow, and the erosion hazard is slight. This soil is somewhat difficult to till.

Most of the acreage is used for irrigated crops of alfalfa, small grains, corn, and sugar beets and for pasture and orchards. Capability units I-1, irrigated, and IIIe-U, nonirrigated.

Payson Series

The Payson series consists of deep, moderately well drained, nearly level, saline-alkali soils. These soils are on undulating, low lake terraces, generally near the base of terrace escarpments, mainly in the vicinity of the Spanish Fork and the Springville city dumps. These soils formed in clayey, calcareous lake sediments derived mainly from weathered shale and limestone.

These soils are at elevations between 4,530 and 4,560 feet. The average annual precipitation is 12 to 14 inches. The soils are usually moist. Depth to the water table ranges from 40 to 60 inches. The mean annual soil temperature is 47° to 52° F., and the frost-free period is 130 to 150 days.

In a typical profile, the surface layer is very dark grayish-brown to dark-brown, calcareous silt loam and silty clay loam about 9 inches thick. The subsoil, about 20 inches thick, is brown, strongly alkaline, calcareous silty clay and clay. The substratum is brown to pale-brown, strongly alkaline clay.

The vegetation consists mainly of greasewood, pickleweed, saltgrass, and alkali sacaton.

Payson soils are used mainly for range, but some areas are used for dryland crops.

Representative profile of Payson silty clay loam in a range area 1/8 mile south of Springville city dump, at a point 2,000 feet west and 1,320 feet south of the NW. corner of section 8, T. 8 S., R. 3 E.:

A21--0 to 4 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, thick, platy structure that parts to moderate, thin, platy; slightly hard, friable, slightly sticky, and slightly plastic; common very fine roots; few very fine pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 7.9); abrupt, smooth boundary.

A22--4 to 9 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; weak, thick, platy structure that parts to moderate,

medium, granular; very hard, firm, sticky, and plastic; common very fine roots; few very fine, discontinuous pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.0); abrupt, smooth boundary.

B1--9 to 14 inches, pale-brown (10YR 6/3) silty clay, dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure that parts to strong, medium, angular blocky; very hard, very firm, sticky, and plastic; few very fine pores; few thin clay films; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.9); clear, smooth boundary.

B2t--14 to 21 inches, brown (10YR 5/3) clay, brown (10YR 4/3) when moist; strong, medium, prismatic structure that parts to strong, medium, angular blocky; extremely hard, extremely firm, very sticky, and very plastic; few very fine roots; few, very fine, discontinuous pores inside peds; many, moderately thick, slightly calcareous clay films on outside of peds; moderately calcareous; lime occurs as soft nodules inside peds, 5 to 15 millimeters in diameter; strongly alkaline (pH 8.5); clear, smooth boundary.

B3ca--21 to 29 inches, very pale brown (10YR 7/3) clay, brown (10YR 5/3) when moist; moderate, prismatic structure that parts to moderate, medium and fine, subangular blocky; extremely hard, extremely firm, very sticky, and very plastic; few very fine roots; no visible pores; common moderately thick clay films on outside of peds; strongly calcareous; strongly alkaline (pH 8.7); clear, smooth boundary.

C1ca--29 to 33 inches, very pale brown (10YR 7/3) clay, brown (10YR 5/3) when moist; strong, thick, platy structure; extremely hard, extremely firm, very sticky, and very plastic; few very fine roots; no visible pores; few thin clay films; very strongly calcareous; lime is disseminated; some soft nodules of lime; moderately saline; strongly alkaline (pH 8.9); clear, smooth boundary.

C2ca--33 to 48 inches, very pale brown (10YR 7/3) clay, pale brown (10YR 6/3) when moist; strong, thick, platy structure; extremely hard, extremely firm, very sticky, and very plastic; no visible roots or pores; strongly calcareous; lime is disseminated; moderately saline; strongly alkaline (pH 8.9); diffuse, wavy boundary.

C3--48 to 68 inches, very pale brown (10YR 7/3) clay, pale brown (10YR 6/3) when moist; few, fine, prominent, strong-brown (7.5YR 5/8) mottles; strong, thick, platy structure; extremely hard, extremely firm, very sticky, and very plastic; no visible roots or pores; strongly calcareous; lime is disseminated; moderately saline; strongly alkaline (pH 8.7).

The A1 horizon is thin or is absent. The A2 horizon is very dark grayish brown to dark grayish brown and is 2 to 10 inches thick. It is slightly to moderately calcareous; the structure ranges from thin to thick. The B2t horizon ranges from heavy silty clay loam to clay and is more than 35 percent clay; the color is dark grayish brown to grayish brown or brown to pale brown; the peds are noncalcareous to slightly calcareous on the outside and moderately or strongly calcareous on the inside. Mottles are generally below a depth of 40 inches. In the B2t horizon the exchangeable sodium ranges from 15 to 35 percent, and the reaction ranges from moderately alkaline to strongly alkaline. The B3ca horizon is brown or pale-brown heavy loam to clay. The Cca horizon is strongly or very strongly calcareous and is dark grayish brown or very pale brown to brown. Below the B2t horizon the content of exchangeable sodium ranges from 20 to 90 percent.

Payson silty clay loam (0 to 1 percent slopes) (Pd).--A profile of this soil is the one described as typical of the series. This soil is nonsaline and nonalkali in the surface layer. The subsoil and substratum are moderately or strongly saline and strongly alkali. The subsoil is typically clay. The substratum ranges from silt loam to clay. In places the surface layer ranges from silt loam to clay.

Included with this soil in mapping is a small acreage, 1 1/2 miles northwest of the Utah Lake pumping plant, that lacks a water table and the soil is usually dry and is very strongly saline-alkali below a depth of about 20 inches.

Artificial drainage has been installed in places, but drainage is difficult because of the fine texture and slow permeability of the soil. Spots of strongly saline-alkali soils about 1/2 acre in size, are common.

Payson silty clay loam is moderately well drained and is slowly permeable. Rooting depth is restricted mainly to the surface layer by the layers of clay. The soil holds about 11 inches of water to a depth of 5 feet, but because of the salt content only 6 to 9 inches of water is available to plants. Runoff is slow. In places free water stands on the surface until it evaporates. There is a slight hazard of water erosion. The natural fertility is low.

This soil is used mainly for pasture. Irrigated pasture, barley, alfalfa, and corn also are grown, but they grow poorly unless the soil has been drained and reclaimed. Grasses and deep-rooted legumes tend to loosen the soil and to improve aeration and permeability. Capability unit VIIw-285, nonirrigated.

Payson-Terrace escarpments complex, 1 to 20 percent slopes (PEE).--This complex consists of Payson silty clay loam and of Terrace escarpments (pl. V, bottom) on the dissected lake terraces mainly between the city dumps of Spanish Fork and Springville. The Payson soil makes up about 45 percent of the complex and Terrace escarpments 30 percent.

The Payson soil is nearly level and occurs on the top of the terraces. Its profile is like that described as typical for the Payson series. It is moderately well drained and slowly permeable. Runoff is slow, and the erosion hazard is slight. The

Terrace escarpments have slopes of 2 to 20 percent; the soil material is strongly saline, stratified silt loam to silty clay. The vegetation is a sparse growth of salt-tolerant plants.

Included in the mapping are areas of unnamed, nearly level, saline-alkali, loamy soils that make up about 25 percent of the complex. These soils occupy the bottoms of drainageways or swales.

This soil and land type are used mainly for range. The rough topography, salt, and alkali make them generally unsuitable for cultivation. Seedings of wheatgrass are successful in a few irrigated areas. Small grains and alfalfa are also grown. The Payson soil is in capability unit VIIw-285, nonirrigated Terrace escarpments is in capability unit VIIIw-8, nonirrigated.

Peteetneet Series

The Peteetneet series consists of noncalcareous, nearly level, peat soils in depressions where springs and seeps occur, mainly in an area between Utah Lake and Vineyard Road. These soils formed under conditions of very poor drainage. The organic matter derived from tules, sedges, cattails, and other coarse, water-loving plants; the present vegetation is also these water-loving plants.

Peteetneet soils are at elevations of 4,486 to 4,495 feet. The average annual precipitation is 14 to 16 inches. The frost-free period is 130 to 150 days, and the mean annual soil temperature is 47° to 49° F.

In a typical profile, the surface layer is black, neutral to slightly acid peat about 15 inches thick. Below this is black, neutral, very friable, mixed muck and root fibers.

Peteetneet soils are not extensive in this survey area. They are used only for pasture.

Representative profile of Peteetneet peat in a pasture 1/2 mile northwest of the Lakeview church, at a point 400 feet south of the center of section 28, T. 6 S., R. 2 E.:

011--0 to 2 inches, dark grayish-brown (10YR 4/2) roots and peat, black (10YR 2/1) when moist; slightly hard, very friable, nonsticky, and nonplastic; many roots; strongly calcareous; lime is disseminated and is in soft nodules 1/4 to 3/4 inch in diameter; mildly alkaline (pH 7.6); clear, smooth boundary.

012--2 to 7 inches, very dark grayish brown (10YR 3/2) peat, black (10YR 2/1) when moist; slightly hard, very friable, nonsticky, and nonplastic; many roots; neutral (pH 7.0); clear, smooth boundary.

021--7 to 15 inches, black (10YR 2/1) peat, black (10YR 1/1) when moist; hard, very friable, nonsticky, and nonplastic; many roots; slightly acid (pH 6.4); gradual, smooth boundary.

022--15 to 31 inches, black (10YR 2/1) muck and few fibers, black (10YR 1/1) when moist; hard, very friable, nonsticky, and nonplastic; neutral (pH 7.1); gradual, wavy boundary.

023--31 to 60 inches, black (10YR 2/1) muck and few plant and root fibers, black (10YR 1/1) when moist; very hard, very friable, nonsticky, and nonplastic; neutral (pH 7.1).

The combined thickness of the organic material over mineral material ranges from 36 inches to more than 60 inches.

Peteetneet peat (0 to 1 percent slopes) (Pf).--A profile of this soil is the one described as typical of the series.

Included with this soil in mapping are small areas of Ironton loam and of Logan silty clay loam. Also included are small areas where the organic material is less than 36 inches thick over the mineral underlying material. In areas of springs and seeps these soils occur in fairly elongated areas that are 200 to 500 feet wide; these areas are 2 to 4 feet higher in the middle than at the outer edges.

This soil is very poorly drained and is moderately permeable. Runoff is ponded. The water table is at or near the surface, and plant roots are near the surface. Except when the surface is frozen, water moves upward to the surface by a wick-like process. Natural fertility is high.

This soil is used for pasture and as wildlife habitat. The native grasses are cut for hay in a few places. Attempts to market this soil as peat moss have been unsuccessful. Capability unit VIIw-22, nonirrigated.

Peteetneet-Holdaway complex (0 to 1 percent slopes) (Pg).--This complex consists of Peteetneet peat that is finely intermingled with Holdaway silt loam. About 60 percent of the mapping unit is Peteetneet peat and 40 percent is Holdaway silt loam. Each soil has a profile similar to the one described as representative for its respective series.

The Peteetneet soil occupies the lower, wetter areas of this complex. It is very poorly drained, and water is near or at the surface most of the time. The Holdaway soil is on low ridges that are 3 to 6 feet higher than the Peteetneet soil. It occupies areas 1 to 2 acres in size. The Holdaway soil is poorly drained and is moderately slowly permeable.

Included in the mapping are small areas of Logan silty clay loam. The Holdaway soil is drier, and livestock prefer it to the wetter Peteetneet soil. Consequently, it receives more grazing.

These soils are used for grazing in dry seasons, and they provide habitat for wildlife. Livestock prefer to graze the drier Holdaway soil. Capability unit VIIw-22, nonirrigated.

Picayune Series

The Picayune series consists of deep, well-drained, cobbly soils on hillsides, mainly in Picayune, Payson, and Pole Canyons. Slopes range from 35 to

70 percent. These soils formed in colluvium or alluvium derived from limestone.

Elevations range from 5,500 to 7,500 feet. The average annual precipitation ranges from 18 to 24 inches. The soils are usually moist but are dry in all parts at depths between 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 45° to 47° F., and the mean summer soil temperature ranges from 60° to 65° F. at a depth of 20 inches. The frost-free period is 80 to 100 days.

In a typical profile, the surface layer is very dark grayish-brown, neutral, cobbly silt loam about 6 inches thick. The subsoil is dark-brown to brown, moderately calcareous, firm, cobbly silty clay loam about 23 inches thick. The substratum is light brownish-gray, very strongly calcareous, friable cobbly silt loam.

The vegetation consists of big sagebrush, Gambel oak, spiked wheatgrass, and a few maples.

Picayune soils are used for grazing livestock and as wildlife habitat.

Representative profile of Picayune cobbly silt loam, 35 to 70 percent slopes, eroded, in a range area in Pole Canyon, about 3 1/2 miles south of Santaquin city, at a point about 1,500 feet south and 2,500 feet east of the NW. corner of section 25, T. 10 S., R. 1 E.:

A1--0 to 6 inches, dark grayish-brown (10YR 4/2) cobbly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure that parts to moderate, fine, granular; slightly hard, friable, slightly sticky, and plastic; common fine and very fine roots; few, medium and fine, discontinuous pores; neutral (pH 7.2); clear, smooth boundary.

B2--6 to 12 inches, brown (10YR 5/3) cobbly silty clay loam, dark brown (10YR 3/3) when moist; moderate, fine, blocky structure; hard, firm, slightly sticky, and plastic; common fine and very fine roots; few, fine, discontinuous pores; moderately calcareous; lime occurs as nodules; soil mass is noncalcareous; mildly alkaline (pH 7.4); clear, smooth boundary.

B31ca--12 to 23 inches, brown (10YR 5/3) cobbly silt loam, brown (7.5YR 4/3) when moist; moderate, fine and medium blocky structure; hard, firm, slightly sticky, and plastic; few fine and very fine roots; few, medium and fine, discontinuous pores; strongly calcareous; lime is well disseminated and is in tiny nodules; mildly alkaline (pH 7.4); gradual, smooth boundary.

B32ca--23 to 29 inches, brown (10YR 5/3) cobbly heavy clay loam, brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; hard, firm, slightly sticky, and plastic; few fine and very fine roots; few, very fine, discontinuous pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.6); gradual, wavy boundary.

C1ca--29 to 53 inches, light-gray (10YR 7/2) cobbly silt loam, light brownish gray (10YR 6/2) when moist; massive; slightly hard, friable, slightly sticky, and plastic; few medium and fine roots; few, very fine, discontinuous pores; very strongly calcareous; lime is in medium sized soft nodules and is well disseminated; some limestone saprolite; mildly alkaline (pH 7.7).

The A horizon is very dark grayish brown, very dark brown, or dark brown. The B horizon is dark-brown to brown or very dark grayish-brown to dark grayish-brown cobbly silty clay loam or cobbly clay loam that contains 27 to 35 percent clay and more than 15 percent sand coarser than very fine sand. The lime content ranges from 0 to 15 percent but is mainly less than 10 percent. The C horizon ranges from brown to pale-brown or grayish-brown to light brownish-gray silty clay loam to silt loam. It is strongly to very strongly calcareous. Reaction is neutral or mildly alkaline throughout the profile.

Picayune cobbly silt loam, 35 to 70 percent slopes, eroded (PHG2).--A profile of this soil is described as typical of the series. This soil occurs on very steep mountain slopes, generally in large areas. At the lower elevations, this soil is on north- and east-facing slopes, but at the higher elevations it is on all slopes.

The surface layer ranges from 6 to 8 inches in thickness and generally contains no lime or is only slightly calcareous. The surface layer is 2 or 3 inches thicker in the areas of oakbrush than it is in open areas. Rills are common, and there are a few gullies 2 feet deep. Lime in the subsoil is typically in nodules, but the soil mass has no lime. In places, there are remnants of a weathered lime hardpan in the subsoil. The substratum ranges from strongly calcareous to extremely calcareous.

In places, especially at the higher elevations, the south-facing slopes have open areas of sagebrush interspersed with oakbrush. In these open areas, the surface layer is only 2 to 3 inches thick and cobblestones or larger stones range from 50 to 60 percent. The subsoil is 70 to 80 percent cobblestones and larger stones.

Included with this soil in mapping are small areas of Rake extremely stony soils and a few areas of unnamed soils that have a clay subsoil.

This Picayune soil is well drained and has moderate permeability. Roots generally penetrate to a depth of 5 feet or more, but in some places the cobblestones and larger stones in the subsoil restrict the penetration of roots. This soil holds about 7 inches of available water. Runoff is medium to rapid, and the erosion hazard is moderate to severe. The natural fertility is moderate.

This soil is suited to range. Clearing brush and seeding is not feasible on the very steep slopes. Capability unit VIIe-M, nonirrigated.

Picayune-Rake association, 35 to 70 percent slopes, eroded (PJG2).--This association is mainly in Picayune and Payson canyons. About 60 percent is Picayune cobbly silt loam, 35 to 70 percent slopes, and the rest is Rake extremely stony loam, 20 to 70 percent slopes, eroded. The Picayune soil is in pockets and on the north- and east-facing slopes. Its profile is similar to the one described as typical for the series. The surface layer is 6 to 8 inches thick. The Rake soil occupies the south- and west-facing slopes and the ridgetops. Its profile is similar to that described as typical for the Rake series. Roots penetrate to the hardpan.

Included with this association in mapping are some limestone outcrops and a few small areas of an unnamed soil that has a clay subsoil.

The Picayune and Rake soils are well drained. The Picayune soil is moderately permeable. Runoff is medium from the Rake soil, and the erosion hazard is moderate.

The vegetation is mainly big sagebrush, cliffrose, cheatgrass, spiked wheatgrass, oakbrush, and scattered maple and conifers. The Picayune soil is in capability unit VIIe-M, nonirrigated; the Rake soil is in capability unit VIIs-UX3, nonirrigated.

Picayune Series, Red Variant

The Picayune series, red variant, consists of deep, well-drained, cobbly soils on mountain slopes, mainly in Pole Canyon south of Santaquin city. Slopes range from 30 to 60 percent. These soils formed in colluvium and alluvium derived from red shale and limestone.

Elevations range from 5,500 to 7,000 feet. The average annual precipitation ranges from 18 to 24 inches. The soils are usually moist, but they are dry in all parts at depths of 7 to 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 45° to 47° F., and the summer soil temperature at 20 inches below the surface ranges from 60° to 65° F. The frost-free period is 80 to 100 days.

In a typical profile of the red variant from the Picayune series, the surface layer is dark reddish-brown, mildly alkaline cobbly loam about 3 inches thick. The subsoil is dark reddish-brown, mildly alkaline, firm cobbly loam about 13 inches thick. The substratum is red, mildly alkaline, firm clay loam. Red, partly decomposed shale occurs at a depth of about 24 inches.

The vegetation consists of big sagebrush, brushy Gambel oak, and bluebunch wheatgrass.

Representative profile of Picayune cobbly loam, red variant, 30 to 60 percent slopes, in a range area in Pole Canyon about 3 miles south of Santaquin city, at a point about 1,500 feet south and 2,200 feet east of the NW. corner of section 24, T. 10 S., R. 1 E.:

A1--0 to 3 inches, reddish-brown (5YR 4/4) cobbly loam, dark reddish brown (5YR 3/3) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine roots; few, medium, continuous pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.8); clear, smooth boundary.

B2--3 to 10 inches, reddish-brown (5YR 5/4) cobbly loam, dark reddish brown (5YR 3/4) when moist; moderate, fine, subangular blocky structure; slightly hard, firm, slightly sticky, and plastic; common very fine and few fine roots; common, fine, discontinuous pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.4); gradual, smooth boundary.

B3ca--10 to 16 inches, reddish-brown (2.5YR 5/4) cobbly clay loam, red (2.5YR 4/6) when moist; moderate, medium and fine, blocky structure; hard, firm, slightly sticky, and plastic; few fine and very fine roots; few, fine, discontinuous pores; few, weathered shale fragments; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.5); gradual, wavy boundary.

C1ca--16 to 24 inches, light reddish-brown (2.5YR 6/4) clay loam, red (10YR 4/6) when moist; massive; very hard, firm, sticky, and plastic; few fine and very fine roots; no visible pores; common weathered shale fragments; strongly calcareous; lime occurs as flakes, coatings, and soft nodules; mildly alkaline (pH 7.8); gradual, wavy boundary.

C2--24 to 40 inches, light-red (10YR 6/6) partly decomposed shale that is easily broken down to clay loam, red (10YR 5/8) when moist.

The A horizon ranges from 2 to 5 inches in thickness, and has 20 to 50 percent cobblestones and gravel and, in places, larger stones. It is generally moderately calcareous but is noncalcareous in places. The texture of the B horizon is typically cobbly clay loam but ranges to cobbly silty clay loam; the color ranges from dark reddish brown to red, and the content of gravel and cobblestones is 20 to 50 percent. Depth to shale bedrock ranges from 20 to 40 inches.

Picayune cobbly loam, red variant, 30 to 60 percent slopes (PIF).--A profile of this soil is described as typical for this variant of the Picayune series. This soil has a profile similar to the one described as typical for the Picayune series, except that it is redder (5YR and 2.5YR hues) and is 20 to 40 inches deep over shale or limestone bedrock. On the steeper slopes are areas of 1/4 acre or less where erosion has removed the original surface layer. Very little vegetation is in these areas, and the landscape has a red spotted appearance. Rills and shallow gullies are common, and in places the gullies are 3 to 5 feet deep.

Included with this soil in mapping are small areas of Picayune and Rake soils.

This soil is well drained and permeability is moderately slow in the subsoil. Roots penetrate to the bedrock. This soil holds 3 to 5 inches of available water, depending on the soil depth. Runoff is rapid, and erosion is a severe hazard. Natural fertility is moderate.

This soil is suited to range. Clearing brush and seeding by machinery are possible on slopes of less than 35 percent on selected sites. Capability unit VIIe-M, nonirrigated.

Pits and Dumps

Pits and Dumps (PK) is a miscellaneous land type that consists of areas of open pits and of areas where soil material has been dumped in uneven piles along canals, railroad tracks, roads, and gravel pits. The pits are open excavations from which the soil material, gravel, and underlying material have been removed. Most of the acreage, especially near Lehi city and east of the Geneva Steel Plant, consists of borrow areas from which the soil has been removed for fill or foundation material for road construction. Some borrow areas include spoil banks piled on the sides of cuts.

This land has no farming value. Capability unit VIIIs-4, nonirrigated.

Pleasant Grove Series

The Pleasant Grove series consists of deep, well-drained, gravelly or cobbly soils on alluvial fans and colluvial slopes near the base of the Wasatch Mountain, mainly between the town of Alpine and Hobble Creek Canyon. Slopes range from 3 to 60 percent. These soils formed in alluvium and colluvium derived mainly from weathered limestone, shale, and quartzite (pl. VI, bottom).

Elevations range from 4,600 to 5,700 feet. The average annual precipitation is 14 to 18 inches. These soils are usually moist, but they are dry in all parts at depths of 7 to 20 inches for more than 60 consecutive days in summer. The mean annual temperature is 48° to 52° F., and the frost-free period is 150 to 170 days.

In a typical profile, the surface layer is very dark brown, mildly alkaline, calcareous, cobbly or stony loam about 21 inches thick. Below this is brown, strongly calcareous, friable or very friable, very cobbly light loam or fine sandy loam.

The vegetation consists mainly of bunchgrass, big sagebrush, cheatgrass, and brushy Gambel oak.

The Pleasant Grove soils are used mainly for orchards and for grazing.

Representative profile of Pleasant Grove stony loam, 10 to 25 percent slopes, eroded, under a cover of cheatgrass 2 miles southeast of Provo city, at a point 350 feet south and 3,000 feet east of the NW. corner of section 17, T. 7 S., R. 3 E.:

A11--0 to 2 inches, very dark grayish-brown (10YR 3/2) stony light loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky, and slightly plastic; many fine and very fine roots; common fine and medium pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.4); clear, smooth boundary.

A12--2 to 6 inches, dark grayish-brown (10YR 4/2) cobbly light loam, very dark brown (10YR 2/2) when moist; weak, thick, platy structure that parts to weak, fine, subangular blocky; soft, very friable, nonsticky, and slightly plastic; many fine and very fine roots; few large and medium pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.7); clear, smooth boundary.

A13--6 to 21 inches, dark grayish-brown (10YR 4/2) cobbly light loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, subangular blocky structure; soft, friable, slightly sticky, and slightly plastic; many fine and few medium roots; few medium and common fine pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.6); gradual, smooth boundary.

C1ca--21 to 38 inches, pale-brown (10YR 6/3) very cobbly light loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; common fine and few medium roots; few medium and fine pores; strongly calcareous; lime is disseminated; moderately thick or thick coatings on rock fragments; mildly alkaline (pH 7.8); clear, wavy boundary.

C2ca--38 to 49 inches, pale-brown (10YR 6/3) very cobbly fine sandy loam, brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky, and nonplastic; few fine roots; few, fine, interstitial pores; strongly calcareous; lime is disseminated; moderately thick or thick coating on rock fragments; mildly alkaline (pH 7.8); clear, wavy boundary.

C3ca--49 to 60 inches, brown (10YR 5/3) very cobbly light loam, brown (10YR 4/3) when moist; massive; soft, friable, slightly sticky, and slightly plastic; few fine roots; few, fine, interstitial pores; strongly calcareous; lime is disseminated; moderately thick or thick coating on rock fragments; mildly alkaline (pH 7.8).

The A horizon is very dark brown to very dark grayish brown or dark brown. The Cca horizon is brown, grayish-brown, dark-brown, or olive-brown very cobbly or very gravelly light loam or fine sandy loam; the content of coarse fragments ranges from 50 to 75 percent. The lime content ranges from 15 to 88 percent, and slight cementation may occur where the lime content is highest. Reaction ranges from neutral to moderately alkaline. These soils are moderately to strongly calcareous.

Pleasant Grove gravelly loam, 3 to 6 percent slopes (PlC).--This soil has a profile similar to that described as typical for the Pleasant Grove series. Gullies have not formed in areas of this soil. Southeast of Pleasant Grove city, this soil has a distinct olive color; the alluvium in this area was deposited by Grove Creek and consists of a mixture of limestone and olive-colored shale.

Included with this soil in mapping are a few small areas of soils having slopes of 1 to 3 percent. Some areas lack gravel. Northeast of Orem city near 1600 North there also is an area of about 65 acres of soils that have a surface layer of gravelly silty clay loam. About 1/4 mile northeast of the State Hospital, there is an area of about 8 acres of soils that are mottled at a depth of about 12 inches. The water table is at the surface for part of the year.

This soil is well drained and is moderately rapidly permeable. Roots penetrate to a depth of 5 feet or more. The available water capacity is about 4 inches to a depth of 5 feet. Runoff is slow, and the erosion hazard is moderate.

This soil is used for pear, cherry, apple, and peach orchards and for alfalfa, pasture, and small grains. Capability unit IIIs-14, irrigated.

Pleasant Grove gravelly loam, 6 to 10 percent slopes (PlD).--This soil has a profile similar to that described as typical for the Pleasant Grove series, except that the coarse fragments are mainly gravel instead of stones. Near the end of the fans or slopes, the soil material is only 2 or 3 feet thick over lake sediments.

Included with this soil in mapping are some small areas that have cobblestones or larger stones on the surface. Also included are local areas where the surface layer lacks gravel or cobblestones. Southeast of Pleasant Grove city, this soil has a distinct olive color; the parent material derived from a mixture of limestone and olive-colored shale.

This soil is well drained and is moderately rapidly permeable. Roots penetrate to a depth of 5 feet or more. About 4 inches of available water is held by this soil to a depth of 5 feet. Runoff is medium. The erosion hazard is severe, but no gullies have formed.

About half of the acreage is used for range, and the rest is used for irrigated pear, peach, cherry, and apple orchards. Capability unit IIIe-14, irrigated, and IVe-UX, nonirrigated.

Pleasant Grove stony loam, 10 to 25 percent slopes, eroded (PmE2).--A profile of this soil is the one described as typical of the Pleasant Grove series (pl. III, top right). The surface layer typically is 20 to 30 inches thick. This soil generally contains 50 to 90 percent gravel, cobblestones, or larger stones, but there are layers with less than 50 percent in places. Sheet erosion and gully erosion are active, and rills and gullies have formed. The gullies are as much as 5 feet deep and are 300 feet to 1/2 mile or more apart.

Included with this soil is mapping, along dry stream channels, are a few areas of extremely stony soils. They have about 15 percent of the surface covered with stones ranging from 6 feet in diameter to cobblestones. In these areas the surface layer is only about 6 inches thick and is 60 to 80 percent gravel or cobblestones. Debris or mud and rock flows deposited by floods have buried the surface layer in places. There is a small acreage of soils having slopes of 25 to 30 percent. Also included are unnamed soils that have a noncalcareous surface layer.

This soil is well drained and is moderately rapidly permeable. Roots penetrate to a depth of 5 feet or more. The soil holds about 4 inches of available water. Runoff is medium, and the erosion hazard is very severe in irrigated areas. The natural fertility is moderate.

This soil is used for range and for irrigated apple, pear, cherry, and peach orchards. Capability units IVs-14, irrigated, and VIs-U4, dryland.

Pleasant Grove-Terrace escarpments complex, 30 to 60 percent slopes, eroded (PNG2).--This complex is in the foothills of the Wasatch Mountains (pl. IV, top). About 80 percent of the complex is Pleasant Grove stony sandy loam, 30 to 60 percent slopes, eroded, and the rest is Terrace escarpments. The Terrace escarpments consist of very gravelly, sandy lake sediments that lack a dark-colored surface layer or are less than 6 inches thick. In many places boulders, 4 to 8 feet in diameter, have rolled from the limestone ledges. The Pleasant Grove soil has a stony sandy loam surface layer, otherwise its profile is similar to that described as typical for the Pleasant Grove series. Rills and shallow gullies are common.

Included with this complex in mapping, 3/8 mile north of the Olmstead plant, is an area of about 100 acres of a pink silt loam soil that formed in residium and colluvium derived from shale and, in many places, has an overwash of gravelly loam.

The soils in this complex are used for range, sand and gravel pits, and watersheds. Grazing is prohibited in many places so as to slow runoff and to reduce flooding in the major cities and towns in lower areas. Pleasant Grove soil is in capability unit VIIs-UX4, nonirrigated; the Terrace escarpments are in capability unit VIIIs-4, nonirrigated.

Pleasant Vale Series

The Pleasant Vale series consists of deep, calcareous, well-drained soils. These soils are on flood plains and alluvial fans, mainly along the Spanish Fork River near the towns of Palmyra, Lake Shore, and Benjamin. Slopes range from 0 to 10 percent. These soils formed in alluvium derived from sandstone, shale, and limestone.

Elevations range from 4,500 to 5,200 feet. The average annual precipitation ranges from 14 to 16 inches. The soils are usually moist, but they are dry in all parts at a depth of 7 to 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 49° to 52° F., and the frost-free period is 130 to 170 days.

In a typical profile, the surface layer is dark-brown, mildly alkaline, strongly calcareous loam about 17 inches thick. At a depth between 17 and 60 inches is brown, moderately alkaline, strongly calcareous, friable light loam or very fine sandy loam.

The vegetation consists of big sagebrush, western wheatgrass, cheatgrass, and annual weeds.

The Pleasant Vale soils are used to grow irrigated alfalfa, corn, small grains, pasture, and sugar beets. In places they are also used for apple orchards.

Representative profile of Pleasant Vale loam, 0 to 2 percent slopes, in an alfalfa field 1 mile south and 1/2 mile east of the town of Palmyra, 3,000 feet north and 2,000 feet east of the SW. corner of section 14, T. 8 S., R. 2 E. and about 1,000 feet north of the east-west road:

Ap--0 to 6 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; weak, thick, platy structure that parts to weak, thin, platy; hard, friable, slightly sticky, and plastic; common fine and very fine roots; common, fine and very fine, discontinuous pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.6); clear, smooth boundary.

A1--6 to 17 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; moderate, medium, granular structure; hard, friable, slightly sticky, and plastic; common fine and very fine roots; common, fine and very fine, discontinuous pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.7); clear, smooth boundary.

C1--17 to 24 inches, pale-brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) when moist; massive; slightly hard, very friable, slightly sticky, and slightly plastic; few very fine roots; few, very fine, discontinuous pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.

C2--24 to 40 inches, light-brown (7.5YR 6/3) very fine sandy loam, brown (7.5YR 3/2) when moist; massive; slightly hard, very friable, slightly sticky, and slightly plastic; few very fine roots; common, very fine, discontinuous pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.1); clear, smooth boundary.

C3--40 to 48 inches, light-brown (7.5YR 6/3) very fine sandy loam, brown (7.5YR 5/3) when moist; massive; soft, very friable, nonsticky, and nonplastic; few very fine roots; few, very fine, discontinuous, interstitial pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.5); clear, smooth boundary.

C4--48 to 60 inches, light-brown (7.5YR 6/3) very fine sandy loam, brown (7.5YR 5/3) when moist; massive; soft, very friable, nonsticky, and nonplastic; few very fine roots; no visible pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.5).

The A horizon is very dark brown to dark-brown or very dark grayish-brown loam, silty clay loam, or gravelly loam. The C horizon is dark grayish-brown to brown. To a depth of about 40 inches, it is loam or very fine sandy loam with less than 18 percent clay and more than 15 percent sand coarser than very fine sand. Below a depth of 40 inches, it is silty clay loam to loamy sand. Reaction is moderately or strongly alkaline. The organic-matter content decreases regularly with depth and is less than 0.5 percent to a depth of 50 inches below the surface.

Pleasant Vale gravelly loam, extended season, 1 to 3 percent slopes (PpB).--This soil is on alluvial fans. Its profile is similar to the one described as typical for the Pleasant Vale series. The surface layer is gravelly loam or gravelly sandy loam 5 to 20 inches thick. The gravel content ranges from 20 to 35 percent.

Included with this soil in mapping are areas of soils that have a nongravelly surface layer and some areas of soils that have gravel below a depth of 36 inches. These included areas make up about 20 percent of this mapping unit. Also included in places are soils having slopes of 0 to 1 percent.

This soil is well drained and is moderately permeable. The soil holds about 7 inches of available water. The erosion hazard is only slight. The frost-free period is 150 to 170 days.

This soil is used for irrigated alfalfa, small grains, and apple orchards. Capability unit IIe-1, irrigated.

Pleasant Vale gravelly sandy loam, extended season, 6 to 10 percent slopes (PrD).--This soil is on lake terraces near the foothills, where local alluvium or colluvium has overwashed other soils. Its profile is similar to the one described as typical for the series, except for the overwash of gravelly sandy loam that is 2 to 20 inches thick. Cobblestones occur in places. About 20 percent of this mapping unit consists of nongravelly material.

Because of the slope, runoff is medium and the erosion hazard is severe. The soil holds about 6.5 inches of water available to plants. The frost-free period is 150 to 170 days.

This soil is used mainly for dryland wheat and alfalfa. A few small areas are used for irrigated alfalfa, small grains, and orchards. Capability unit IVe-UX, nonirrigated.

Pleasant Vale loam, 0 to 2 percent slopes (PnA).--A profile of this soil is the one described as typical of the series. This soil is stratified below a depth of about 40 inches. The surface layer is light loam or light silt loam 7 to 20 inches thick. This soil is mainly nonalkali to slightly alkali, but there are areas that are moderately or strongly alkali. In some areas the surface layer is compact, and infiltration of irrigation water is very slow; the growth of alfalfa is markedly reduced in these spots.

Included with this soil in mapping is a small acreage of soils that have a silty clay loam surface

layer. Also included are areas of soils that are mottled above a depth of 40 inches and areas where the water table is between a depth of 40 and 60 inches.

This soil is well drained and is moderately permeable. Roots penetrate to a depth of more than 5 feet. This soil holds about 7.5 inches of available water. Runoff is slow, and most of the precipitation enters the soil. There is no erosion hazard. The natural fertility is moderate, and the soil is friable and is easy to till. The frost-free period is 130 to 150 days.

Most of this soil is used for irrigated alfalfa, small grains, corn, sugar beets, and pasture. Capability unit IIc-2, irrigated.

Pleasant Vale loam, extended season, 0 to 2 percent slopes (PoA).--The profile of this soil is similar to that described as typical for the Pleasant Vale series. In one area about a mile north of Santaquin city, the surface layer is silt loam, and the soil is very calcareous below the surface layer.

Included with this soil in mapping are a few small areas of soils having slopes of 2 to 3 percent. Also included are some areas of soils that have a silty clay loam surface layer. In a few places there is scattered gravel on the surface and in the substratum.

This soil is well suited to the production of irrigated alfalfa, small grains, sugar beets, pasture, and corn. A few apple orchards are being planted. The frost-free period is 150 to 170 days. Capability unit I-1, irrigated.

Pleasant Vale loam, extended season, 3 to 6 percent slopes (PoC).--This soil is on alluvial fans, mainly north of Santaquin city. Its profile is similar to that described for the series. The surface layer is 7 to 12 inches thick.

This soil is well drained and is moderately permeable. Roots penetrate to a depth of more than 5 feet. The available water is about 7.5 inches to a depth of 5 feet. Runoff is medium, and the erosion hazard is moderate. The frost-free period ranges from 150 to 170 days.

Most of the acreage is used mainly for irrigated alfalfa, pasture, and small grains, but apple orchards are also being developed. Capability unit IIIe-1, irrigated.

Pleasant Vale silty clay loam, 1 to 3 percent slopes (PsB).--This soil occurs on flood plains. It has a silty clay loam surface layer 8 to 14 inches thick, otherwise its profile is similar to that described as typical for the series.

The hazard of erosion is slight. This soil is somewhat difficult to work, and it can be cultivated satisfactorily without compaction if the water content is less than 40 percent of the field capacity.

This soil is used for irrigated crops of alfalfa, corn, pasture, sugar beets, and small grains. The frost-free period is 130 to 150 days. Capability unit IIe-2, irrigated.

Pleasant View Series

The Pleasant View series consists of deep, gravelly soils on flood plains of streams near the towns of Alpine, Olmstead, and Springville. Slopes range from 1 to 3 percent. These soils developed in alluvium derived from a mixture of parent rocks, mainly quartzite and granite, but a small amount of limestone.

Elevations range from 4,800 to 5,100 feet. The average annual precipitation is 17 to 20 inches. The soils are usually moist, but they are dry in all parts at depths of 7 to 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 49° to 52° F., and the frost-free period is 150 to 170 days.

In a typical profile, the uppermost 23 inches is very dark grayish-brown, mildly alkaline, fine sandy loam. The next layer is dark grayish-brown, mildly alkaline, gravelly sandy loam. Below a depth of 30 inches is dark grayish-brown, mildly alkaline, very gravelly loamy sand.

The vegetation is mainly cottonwood, boxelder, sagebrush, wild rose, and perennial grasses.

Pleasant View soils are inextensive in this survey area. They are used mainly for growing irrigated alfalfa, small grains, corn, pasture, and apple and cherry orchards. Some areas are in community development.

Representative profile of Pleasant View fine sandy loam, 1 to 3 percent slopes, in a cultivated field 1/2 mile northeast of the town of Alpine at a point 1,430 feet south and 1,290 feet east of the NW. corner of section 19, T. 4 S., R. 2 E.:

Ap--0 to 6 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular; slightly hard, friable, slightly sticky, and slightly plastic; common fine roots; few large and many fine pores; mildly alkaline (pH 7.6); clear, smooth boundary.

C1--6 to 14 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular; slightly hard, friable, slightly sticky, and plastic; few fine roots; few large and fine pores; neutral (pH 7.3); gradual, smooth boundary.

C2--14 to 23 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky, and slightly plastic; few fine roots; few medium and common fine pores; neutral (pH 7.1); gradual, wavy boundary.

IIC3ca--23 to 30 inches, grayish-brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable, nonsticky, and nonplastic; common fine roots;

interstitial pores; moderately calcareous; lime is disseminated and also appears as coatings on gravel; mildly alkaline (pH 7.6).

IIC4ca--30 to 60 inches, grayish-brown (10YR 5/2) very gravelly loamy sand, dark grayish brown (10YR 4/2) when moist; single grain; loose, nonsticky, and nonplastic; few fine roots; moderately calcareous; lime is disseminated and also appears as coatings on gravel; mildly alkaline (pH 7.6).

The A horizon is very dark grayish brown or very dark brown to dark brown. The C horizon is very dark grayish brown to dark grayish brown or dark brown to brown. Texture, to a depth of 30 inches, ranges from light loam to sandy loam with less than 18 percent clay and more than 15 percent sand coarser than very fine sand. It is gravelly fine sandy loam to very gravelly loamy sand below a depth of 30 inches. Coarse fragments, at a depth of 10 to 40 inches, range from 10 to 35 percent but average more than 20 percent. The reaction is neutral to mildly alkaline. The organic-matter content is more than 1 percent to a depth of 20 inches, and it decreases irregularly as depth increases.

Pleasant View fine sandy loam, 1 to 3 percent slopes (PtB).--A profile of this soil is the one described as typical of the Pleasant View series. This soil occurs in medium sized, somewhat elongated areas that parallel stream channels. The surface layer is 20 to 30 inches thick. In about 80 percent of the area southwest of the Olmstead plant in Provo Canyon, this soil has gravel and cobblestones on the surface. In areas in or near Springville city the surface layer is gravelly in about half of the area.

Included with this soil in mapping are areas of soils that have a cobbly sandy loam and loam surface layer.

This soil is well drained and is moderately rapidly permeable. Rooting depth is generally deep, but in places the roots are restricted by gravel and cobblestones below a depth of 40 inches. This soil holds about 5 inches of available water. Runoff is slow, and the erosion hazard is slight. The natural fertility is moderate. This soil is difficult to till where it is gravelly or cobbly.

This soil is used mainly for apple and cherry orchards, but northeast of the town of Alpine it is also used for growing irrigated small grains, corn, pasture, and alfalfa. In Springville city, it is used for community development. Capability unit IIIs-14, irrigated.

Preston Series

The Preston series consists of deep, noncalcareous soils that are near the outer edges of the escarpments on the Highland, Orem, and Mapleton Benches. Slopes range from 0 to 10 percent. These soils occur mainly east of the Geneva Steel Plant and near the Springville Evergreen Cemetery. They formed in sandy lakeshore sediments derived mainly from sandstone and quartzite and have been reworked by the wind.

Elevations range from 4,500 to 4,750 feet. The average annual precipitation ranges from 14 to 19 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 49° to 52° F., and the frost-free period is 150 to 170 days.

In a typical profile, the surface layer is very dark grayish-brown, moderately alkaline, fine sand about 17 inches thick. Below this, to a depth of 60 inches, is brown, loose, fine sand.

The vegetation consists mainly of sand dropseed, wild aster, and rabbitbrush.

The Preston soils are not extensive in this survey area. They are used for irrigated vineyards, orchards, alfalfa, and pasture.

Representative profile of Preston fine sand, 1 to 10 percent slopes, in a vineyard about 1 mile northeast of the Geneva Steel Plant at a point 2,000 feet east and 1,100 feet north of the SW. corner of section 33, T. 5 S., R. 2 E.:

A11--0 to 3 inches, brown (10YR 5/3) fine sand, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky, and nonplastic; few fine roots; few medium and fine pores; noncalcareous; moderately alkaline (pH 7.9); clear, smooth boundary.

A12--3 to 17 inches, brown (10YR 5/3) fine sand, very dark grayish brown (10YR 3/2) when moist; single grain; loose when dry or moist, nonsticky, and nonplastic; few fine roots; few medium pores; noncalcareous; moderately alkaline (pH 8.0); diffuse, wavy boundary.

C1--17 to 33 inches, brown (10YR 5/3) fine sand, brown (10YR 4/3) when moist; single grain; loose when dry or moist, nonsticky, and nonplastic; very few fine roots; few fine and medium pores; noncalcareous; moderately alkaline (pH 8.1); gradual, smooth boundary.

A1b--33 to 45 inches, brown (10YR 5/3) fine sand, brown (10YR 4/3) when moist; single grain; loose when dry or moist, nonsticky, and nonplastic; few fine and medium pores; noncalcareous; moderately alkaline (pH 8.0); gradual, wavy boundary.

C2--45 to 60 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 4/3) when moist; single grain; loose when dry or moist, nonsticky, and nonplastic; few fine pores; noncalcareous; moderately alkaline (pH 8.2); clear, smooth boundary.

The A horizon is dark brown to very dark grayish brown. The C horizon is dark brown to pale brown. Reaction is mildly alkaline to moderately alkaline. The organic-matter content is less than 1 percent in the A horizon.

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Preston fine sand, 1 to 10 percent slopes (PuD).--A profile of this soil is the one described as typical of the series. This soil generally occurs on west-facing slopes. Its surface layer ranges from about 2 to 14 inches in thickness depending on the amount and kind of material recently deposited by the wind. In places there are calcareous silty clay loam lake sediments below a depth of 48 inches. In small areas where this soil joins other poorly drained sandy soils it is mottled below a depth of 36 inches and the water table is at a depth of 45 inches below the surface. In a few places, especially southeast of the Geneva Steel Plant, there are sand dunes 3 to 10 feet high.

Included with this soil in mapping are areas of a Layton loamy fine sand.

This soil is excessively drained and is rapidly permeable. Roots penetrate only to a depth of 40 to 50 inches. This soil holds about 2.5 inches of available water. Runoff is very slow. Water erosion is only a slight hazard, but the hazard of wind erosion is severe. The natural fertility is low.

Most of the acreage is used for irrigated crops, mainly vineyards and cherry and peach orchards. A few small areas are used for range. Several tracts have been used to borrow material for road construction (pl. VI, top), especially for Interstate Highway No. 15, east of the Geneva Steel Plant. Capability unit IVs-14, irrigated.

Preston Series, High Water Table Variant

The Preston series, high water table variant, consists of deep, calcareous, gently sloping soils on low lake terraces. These soils generally have a water table above a depth of 20 inches. They formed in wind-deposited fine sand. Slopes range from 1 to 3 percent.

Elevations range from 4,500 to 4,650 feet. The average annual precipitation ranges from 14 to 19 inches. The mean annual soil temperature is 49° to 52° F., and the frost-free period is 150 to 170 days.

A typical profile of the high water table variant from the Preston series has a very dark-brown, moderately alkaline, loamy fine sand surface layer about 3 inches thick. Below this are stratified layers consisting of dark grayish-brown or very dark grayish-brown to grayish-brown, moderately alkaline, fine sand or loamy fine sand. Distinct mottles occur above a depth of 30 inches.

The vegetation consists mainly of sedges, wiregrass, and some clover.

These soils are not extensive in this survey area. They are used for meadow pasture.

Representative profile of Preston loamy fine sand, high water table variant, in a wet meadow pasture 1/2 mile east of the Geneva Steel Plant dispensary at a point 1,000 feet east and 1,500 feet north of the SW. corner of section 16, T. 6 S., R. 2 E.:

A1--0 to 3 inches, grayish-brown (10YR 5/2) loamy fine sand, very dark brown (10YR 2/2) when moist; massive; soft, very friable, nonsticky, and nonplastic; many roots; no visible pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 7.7); clear, smooth boundary.

C1--3 to 8 inches, light brownish-gray (10YR 6/3) fine sand, dark grayish brown (10YR 4/2) when moist; medium, distinct, dark yellowish-brown (10YR 4/4) mottles; single grain; loose when dry or moist, nonsticky, and nonplastic; common, large, medium, and fine roots; no visible pores; slightly calcareous; lime is disseminated; mildly alkaline (pH 7.7); clear, smooth boundary.

A1b--8 to 15 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard, very friable, slightly sticky, and slightly plastic; many fine and very fine roots; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.6); abrupt, smooth boundary.

C2--15 to 33 inches, grayish-brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) when moist; single grain; loose when dry or moist, nonsticky, and nonplastic; common fine and very fine roots; noncalcareous; mildly alkaline (pH 7.5); gradual, wavy boundary.

C3--33 to 51 inches, light brownish-gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) when moist; few, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; single grain; loose when dry or moist, nonsticky, and nonplastic; noncalcareous; moderately alkaline (pH 8.0); gradual, wavy boundary.

C4--51 to 63 inches, light-gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) when moist; few, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; single grain; loose when dry or moist, nonsticky, and nonplastic; noncalcareous; moderately alkaline (pH 8.2).

A buried surface layer and stratification with other textures are common in this soil.

Preston loamy fine sand, high water table variant (0 to 1 percent slopes) (Pv).--A profile of this soil is described as typical for the high water table variant. This soil has a profile similar to that described for the normal Preston soils, except it has a water table that is generally at a depth of less than 20 inches below the surface. It receives seepage from the irrigated soils on the higher benches or terraces. This soil formed in fine sand deposited by the wind. It occurs on lake terrace escarpments, mainly east of the Geneva Steel Plant.

This soil is poorly drained and is rapidly permeable. The water table fluctuates but generally is at a depth of less than 20 inches. The rooting depth is restricted by the water table. Runoff is very slow. If the plant cover is removed, soil

blowing is a moderate hazard. Natural fertility is moderate in the surface layer.

This soil is used as pasture for livestock. It is suited to crops if drained and leveled. Drains have been installed and the soil reclaimed in places. The drained areas are used for irrigated pasture, barley, oats, and alfalfa. Capability unit IVw-24, irrigated.

Provo Series

The Provo series consists of deep, calcareous, poorly drained, gently sloping soils, mainly on the flood plain of the Provo River. These soils formed in gravelly alluvium derived from limestone, sandstone, and quartzite.

Elevations range from 4,500 to 4,800 feet. The average annual precipitation is 11 to 16 inches. The mean annual soil temperature is 48° to 50° F., and the frost-free period is 130 to 150 days.

In a typical profile, the surface layer is very dark gray, moderately alkaline, gravelly fine sandy loam 15 inches thick. Below this, is dark grayish-brown or very dark grayish-brown, moderately alkaline, very gravelly loamy sand or sand. Depth to the water table is less than 30 inches in undrained areas.

The vegetation consists of cottonwood, boxelder, willow, big sagebrush, cheatgrass, western wheatgrass, and annual weeds.

Provo soils are not extensive in this survey area. They are used for irrigated alfalfa, pasture, and corn. If drained, they can be used for apple orchards.

Representative profile of Provo gravelly fine sandy loam in a cultivated field near the Provo River about 3 miles north of Provo city at a point 2,600 feet east and 1,800 feet south of the NW. corner of section 25, T. 6 S., R. 2 E.:

Ap--0 to 7 inches, dark-gray (10YR 4/1) gravelly fine sandy loam, very dark gray (10YR 3/1) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky, and plastic; few medium and common fine roots; common, very fine, discontinuous pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.2); clear, smooth boundary.

A1g--7 to 15 inches, dark-gray (10YR 4/1) gravelly fine sandy loam, very dark gray (10YR 3/1) when moist; few, fine, distinct, dark reddish-brown (5YR 3/4) mottles; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky, and plastic; few medium and common fine roots; common, very fine, continuous pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.1); clear, smooth boundary.

C1g--15 to 25 inches, dark-gray (10YR 4/1) very gravelly sand, very dark grayish brown (10YR 3/2) when moist; few, coarse, distinct, yellowish-brown (10YR 5/4) mottles; single grain; loose when dry or moist, nonsticky, and nonplastic; common very fine roots; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.1); gradual, smooth boundary.

IIC2--25 to 40 inches, grayish-brown (10YR 5/2) very gravelly loamy sand, dark grayish brown (10YR 4/2) when moist; common, medium, distinct, very dark brown (10YR 2/2) mottles that occur as iron stains on gravel; single grain; loose when dry or moist, nonsticky, and nonplastic; common very fine roots; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.1); gradual, smooth boundary.

IIC3--40 to 50 inches, gray (10YR 5/1) very gravelly sand, dark grayish brown (10YR 4/2) when moist; common, medium, distinct, very dark brown (10YR 2/2) mottles that occur as iron stains on gravel; single grain; loose when dry or moist, nonsticky, and nonplastic; no roots observed; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.1).

The A horizon ranges from 7 to 17 inches in thickness. It is very dark gray if it is not mottled, but if mottled, the color ranges to very dark grayish brown. The content of organic matter is less than 1 percent in the dark-colored layers in the lower part of the A horizon. The upper part of the C horizon is dark gray or very dark gray unless it is mottled; if mottled, it is very dark grayish brown to dark grayish brown. Texture of the C horizon is loamy sand or sand with 50 to 90 percent gravel and cobblestones. The lower part of the C horizon is usually dark grayish brown or brown.

Provo gravelly fine sandy loam (1 to 3 percent slopes) (Pw).--This soil has a profile similar to that described as typical for the series. Its surface layer is 8 to 16 inches thick.

Included with this soil in mapping are small areas of Sunset loam. Also included are some areas of soils that have a nongravelly loam surface layer and a small acreage, in the Mitchell Hollow area north of American Fork city, of soils that have slopes of 3 to 6 percent.

This soil is poorly drained and is rapidly permeable. It holds about 2.5 inches of available water. Runoff is very slow, and the erosion hazard is slight.

This soil is used for irrigated alfalfa, pasture, corn, small grains, and a few apple orchards. It is also being used extensively for community development. Capability unit IVw-24, irrigated.

Provo-Sunset complex (0 to 3 percent slopes) (Px).--This complex is on the flood plain, mainly along the Provo River. About 70 percent of the complex is Provo gravelly fine sandy loam and 30 percent is Sunset loam. These soils do not occur in a regular pattern. The profile of the Provo soil is described as typical for the Provo series. The Sunset soil has a profile similar to that described as typical for the Sunset series.

The Provo soil is poorly drained and is rapidly permeable. It holds about 2.5 inches of available water. Root penetration is restricted by the large amount of gravel or cobblestones below a depth of about 40 inches. Runoff is very slow, and most of the precipitation enters the soil. The erosion hazard is slight. The natural fertility is moderate. Because of the gravel, this soil is difficult to cultivate.

The Sunset soil is moderately well drained and is moderately permeable. Roots penetrate easily to a depth of 5 feet. This soil holds about 9 to 11 inches of available water. Runoff is slow, and the erosion hazard is none to slight.

The soils in this complex are used for alfalfa, small grains, corn, pasture, and in some places, for apple orchards. They are also being used extensively for community development. Capability unit IVw-24, irrigated.

Provo Bay Series

The Provo Bay series consists of deep, very poorly drained, very strongly calcareous, nearly level soils. These soils formed in mixed, very strongly calcareous, medium-textured alluvium. They are in low areas on the valley bottoms, mainly west of the Ironton Steel Plant, and are flooded for periods of 2 months or more in 6 out of 10 years.

Elevations are 4,480 to 4,490 feet. The average annual precipitation ranges from 12 to 14 inches. The mean annual soil temperature is 47° to 50° F., and the frost-free period is 120 to 130 days.

In a typical profile, the surface layer is very dark gray, very strongly calcareous silty clay loam about 13 inches thick. Between a depth of 13 and 22 inches is a layer of mildly alkaline, black clay loam. The underlying material is grayish-brown and gray, strongly calcareous, friable silt loam or loam. Buried horizons are common, and distinct mottles occur above a depth of 20 inches. The content of organic matter is high in the surface layer.

The vegetation consists of tule, sedge, and water-loving weeds.

Provo Bay soils are used for seasonal grazing in dry years and as habitat for waterfowl and other wildlife.

Representative profile of Provo Bay silty clay loam in a range area 2,600 feet south of the south end of the NW.-SE. runway at the Provo Airport, section 22, T. 7 S., R. 2 E.:

A11ca--0 to 3 inches, gray (2.5Y 5/1) silty clay loam, very dark gray (2.5Y 3/1) when moist; weak, coarse, prismatic structure; hard, friable, nonsticky, and plastic; common fine and few medium roots; few large and common medium pores; very strongly calcareous; lime is disseminated; numerous fresh-water snail shells; neutral (pH 7.2); clear, smooth boundary.

A12gca--3 to 8 inches, gray (2.5Y 5/1) light silty clay loam; very dark gray (2.5Y 3/1) when moist; weak, coarse, prismatic structure that breaks to weak, medium to fine, subangular blocky; slightly hard, friable, slightly sticky, and plastic; common fine and few medium and large roots; very strongly calcareous; lime is disseminated; numerous fresh-water snail shells; neutral (pH 7.2); gradual, smooth boundary.

A13gca--8 to 13 inches, gray (2.5Y 5/1) silty clay loam; very dark gray (2.5Y 3/1) when moist; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, moderate to fine, subangular blocky structure; hard, friable, slightly sticky, and plastic; many fine and few medium roots; many fine and few medium pores; very strongly calcareous; lime is disseminated; numerous fresh-water snail shells; neutral (pH 7.3); clear, wavy boundary.

A14gca--13 to 22 inches, dark-gray (10YR 4/1) clay loam, black (10YR 2/1) when moist; massive; hard, friable, slightly sticky, and plastic; common fine and few medium and large roots; common fine and few medium pores; very strongly calcareous; lime is disseminated; numerous fresh-water snail shells; mildly alkaline (pH 7.6); gradual, smooth boundary.

C1--22 to 33 inches, light-gray (2.5Y 7/2) loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few medium and fine roots; common large and few medium and fine pores; strongly calcareous; lime is disseminated; numerous fresh-water snail shells; moderately alkaline (pH 7.9); gradual, smooth boundary.

C2--33 to 60 inches, light brownish-gray (2.5Y 6/2) silt loam, gray (2.5Y 5/1) when moist; massive; hard, friable, slightly sticky, and slightly plastic; few fine and medium roots; common large and few medium and fine pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.7).

The A horizon ranges from silty clay loam to silt loam. Peaty surface layers occur in some areas. The C horizon, or the buried A horizon, ranges from gray to black. Texture ranges from very fine sandy loam to silty clay loam that contains 18 to 35 percent clay and less than 15 percent fine sand or coarser. Reaction is neutral to moderately alkaline.

Provo Bay peaty silt loam (0 to 1 percent slopes) (PY).--This soil has a profile similar to that described as typical for the series, except that it is very frequently flooded and has a peaty silt loam surface layer about 3 to 8 inches thick. It occurs where streams enter Provo Bay and in areas where water is ponded. Rooting depth is restricted by the shallow water table.

This soil is used as wildlife habitat. Capability unit VIIIw-2, nonirrigated.

Provo Bay silty clay loam (0 to 1 percent slopes) (Pz).--A profile of this soil is the one described as typical of the Provo Bay series. This soil is

moderately saline. It occurs mainly in the Provo Bay area and is adjacent to Utah Lake. In places in the southeastern part of the Provo Bay area, this soil has layers of clay below a depth of 40 inches.

This soil is flooded by Utah Lake 8 out of 10 years and for periods of 2 months or more, generally in May and June. The surface layer is buried by calcareous deposits during floods. Depth to the water table varies from season to season and from year to year. It is closely related to the water level of Utah Lake and ranges from 0 to 60 inches below the surface. Underground water moves laterally at a very slow rate.

This soil is poorly drained and is slowly permeable. Surface runoff is ponded, and there is no erosion hazard. This soil holds about 12 inches of water, but the salt content reduces the amount of water available to plants to about 9 inches.

The vegetation is mainly tules, large sedges, and annual weeds.

This soil is used as wildlife habitat and for seasonal grazing in dry years. Barley and turnips have been planted on a trial basis in some fields, which indicates that if drained, reclaimed, and protected from flooding, this soil would produce crops. Capability unit Vw-22, nonirrigated.

Rake Series

The Rake series consists of well-drained, cobbly or stony soils on the west-facing slopes of the Wasatch Mountains. Slopes range from 20 to 70 percent. These soils formed in colluvium and local alluvium derived from limestone and quartzite.

Elevations range from 5,100 to 6,500 feet. The average annual precipitation ranges from 15 to 18 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 47° to 49° F., and the frost-free period is 130 to 150 days.

In a typical profile, the surface layer is very dark grayish-brown, slightly calcareous, mildly alkaline extremely stony loam about 6 inches thick. The subsoil is dark-brown, moderately calcareous, mildly alkaline, firm very cobbly clay loam about 7 inches thick. A hardpan, about 20 inches thick, of indurated lime is at a depth of 13 inches. It is composed of several distinct platy layers 3 to 5 inches thick and is about 50 percent gravel or cobblestones.

The vegetation consists of big sagebrush, brushy Gambel oak, cliffrose, spiked wheatgrass, and bluebunch wheatgrass.

The Rake soils are used for range and as wildlife habitat.

Representative profile of Rake extremely stony loam, 20 to 70 percent slopes, eroded, in a range area about 1 1/2 miles south of Santaquin city at a point about 700 feet south and 1,100 feet west of the NE. corner of section 14, T. 10 S., R. 1 E.:

A1--0 to 6 inches, dark grayish-brown (10YR 4/2) extremely stony loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine roots; few, fine and very fine, discontinuous pores; slightly calcareous; lime is disseminated; mildly alkaline (pH 7.5); clear, smooth boundary.

B2t--6 to 13 inches, dark grayish-brown (10YR 4/2) very cobbly clay loam, dark brown (10YR 3/3) when moist; moderate, fine, subangular blocky structure; hard, firm, sticky, and plastic; common fine and very fine roots; few, fine and very fine, discontinuous pores; few, thin, patchy clay films on ped faces and pores; moderately calcareous; some lime is disseminated but is mainly in small, irregular, hard nodules; mildly alkaline (pH 7.6); abrupt, smooth boundary.

C1cam--13 to 32 inches, four distinct platy hardpan layers, 3 to 5 inches thick, separated by sandy loam 1/8 to 1/2 inch thick; the surface of each layer has a trowled appearance; lamina are about 1/8 inch thick; surface lamina are white (10YR 8/2); when dry subjacent, unlaminated calcrete ranges from very pale brown (10YR 8/3) to pink (7.5YR 7/4); indurated; roots have spread horizontally along the upper smooth surface; common very fine roots; very strongly calcareous; about 50 percent of the calcrete matrix is gravel or cobblestones; clear, wavy boundary.

C2ca--32 to 37 inches, very pale brown (10YR 8/4) very stony sandy loam, light brown (7.5YR 6/4) when moist; single grain; loose when dry or moist; nonsticky and nonplastic; 65 percent stones; very strongly calcareous; lime is disseminated and is in hard, irregular nodules; moderately alkaline (pH 8.1).

The A horizon is very dark brown to very dark grayish brown or dark brown and is 2 to 8 inches thick. The B horizon is very dark grayish brown, dark brown, or dark yellowish brown and is 6 to 12 inches thick. Texture ranges from clay loam to heavy loam with 50 to 70 percent coarse fragments. Depth to the hardpan ranges from 10 to 20 inches. The hardpan ranges from 2 to 20 inches in thickness.

Rake extremely stony loam, 20 to 70 percent slopes, eroded (RAG2).--A profile of this soil is the one described as typical of the series. This steep soil occurs as large areas in the foothills of the Wasatch Mountains. It occupies west-facing hillsides and typically is extremely stony. At the mouth of the Santaquin and Pole Canyons, the parent material is mainly limestone and appears to be a huge flow or landslide of mudrock. The Santaquin Creek has cut its channel through this mass of material from the power plant up the canyon almost to the boundary of the National Forest.

Included with this soil in mapping are areas of a Rake soil that has a lime-cemented hardpan at a depth of 12 to 20 inches; colluvium from the higher slopes has accumulated on the slopes below and generally accounts for the greater depth to the hardpan. In some places, the hardpan is discontinuous, and the soil has an extremely calcareous substratum, and in other places is limestone bedrock that has lime cemented coatings 1/8 to 2 inches thick. Rills and small gullies have formed in places. The surface layer is 1 to 3 inches thicker under the shrubs than in other places. Other inclusions are areas of an unnamed soil that makes up about 20 percent of this mapping unit; this soil is cobbly or stony loam and lacks a hardpan.

Also included, on the steeper slopes, are a few areas of talus slides. Limestone outcrops are scattered throughout the landscape, but they make up only 2 or 3 percent of the area. The steepest ridges are severely eroded, and in these places, erosion has removed almost all of the surface layer and subsoil and pieces of the hardpan and fragments of limestone are on the surface. The profile contains a hardpan only in areas where there is a covering of surface soil.

This soil is well drained. Permeability is moderate above the hardpan and is very slow in the hardpan. Roots penetrate only to the hardpan. This soil holds 2 or 3 inches of available water, depending on the depth to the hardpan. Runoff is medium, and the erosion hazard is moderate on slopes of 40 percent or less. Runoff is rapid, and the hazard of erosion is severe on slopes of more than 40 percent. The natural fertility is moderate.

This soil is used for wildlife habitat and for range in spring and in fall. Capability unit VIIs-UX3, nonirrigated.

Redola Series

The Redola series consists of deep, calcareous, well-drained soils on alluvial fans and flood plains near the town of Alpine and the cities of Springville and American Fork. Slopes range from 0 to 6 percent. These soils formed in alluvium derived from limestone and sandstone.

Elevations range from 4,600 to 5,000 feet. The average annual precipitation ranges from 14 to 16 inches. The soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in the summer. The mean annual soil temperature is 49° or 50° F. The frost-free period is 130 to 150 days.

In a typical profile, the soil material is very dark grayish-brown moderately alkaline, friable loam and light loam to a depth of about 30 inches. Below this is a layer of very dark grayish-brown, mildly alkaline, moderately calcareous, friable very fine sandy loam stratified with thin lenses of coarse sand or gravelly coarse sand. This layer is underlain by dark grayish-brown, slightly calcareous, moderately alkaline gravelly coarse sand.

The vegetation consists of big sagebrush, western wheatgrass, rubber rabbitbrush, and cottonwood.

The Redola soils are used for irrigated alfalfa, small grains, corn, sugar beets, pasture, and apple and pear orchards.

Representative profile of Redola loam, 0 to 3 percent slopes, in a pasture about 1/2 mile east of the town of Alpine, at a point 1,500 feet east and 1,250 feet north of the SW. corner of section 19, T. 4 S., R. 2 E.:

Ap--0 to 8 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure in the uppermost inch or two, and weak, medium, subangular blocky below; hard, friable, slightly sticky, and slightly plastic; few, medium, fine and very fine roots; few, medium, fine and very fine, discontinuous pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 7.9); clear, smooth boundary.

C1--8 to 20 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; massive; hard, friable, slightly sticky, and slightly plastic; few, medium, fine and very fine roots; few fine and common very fine pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.8); gradual, smooth boundary.

C2--20 to 30 inches, grayish-brown (10YR 5/2) light loam, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; few, medium, fine and very fine roots; few, fine and common, very fine, discontinuous pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 7.9); gradual, wavy boundary.

C3--30 to 50 inches, grayish-brown (10YR 5/2) very fine sandy loam stratified with thin lenses of coarse sand or gravelly coarse sand, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; few fine and very fine roots; few fine and common very fine pores; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.8); clear, smooth boundary.

IIC4--50 to 60 inches, light brownish-gray (10YR 6/2) gravelly coarse sand, dark grayish brown (10YR 4/2) when moist; single grain; loose, nonsticky, and nonplastic; few fine and very fine roots; slightly calcareous; moderately alkaline (pH 8.0).

The A horizon and the upper part of the C horizon are very dark brown, very dark grayish-brown, or dark-brown loam, silt loam, or very fine sandy loam containing less than 18 percent clay and more than 15 percent sand coarser than very fine sand. Below a depth of 40 inches, the C horizon ranges from silty clay loam to gravelly sand. Scattered gravel or thin layers of gravel occur in the profile. The soil is moderately to strongly calcareous. In some

areas the profile has layers of noncalcareous soil material between layers of calcareous material. The reaction is mildly alkaline to moderately alkaline. The content of organic matter is more than 1 percent at a depth of 10 to 20 inches; it decreases irregularly with depth and is more than 0.5 percent to a depth of 50 inches below the surface.

Redola loam, 0 to 3 percent slopes (RdA).--A profile of this soil is the one described as typical of the series. The dark-colored layer typically extends to a depth of more than 20 inches, but it is only 10 inches thick in places.

Included with this soil in mapping, along the highway between Pleasant Grove city and the town of Lindon, are areas of a Redola soil that has a silt loam surface layer. Also included in the mapping are small areas of Martini fine sandy loam.

This soil is well drained and is moderately permeable. Roots penetrate to a depth of 5 feet or more. The soil retains between 8 to 11 inches of available water. Runoff is slow, and most of the precipitation enters the soil. The hazard of erosion is only slight. The natural fertility is high, and this soil is easy to work.

This soil is used mainly for irrigated alfalfa, small grains, sugar beets, corn, pasture, and apple orchards. Capability unit IIc-2, irrigated.

Redola gravelly loam, 3 to 6 percent slopes (ReC).--This soil is on alluvial fans and flood plains, generally close to the mountains near the mouth of small canyons. Its profile is similar to that described as typical for the series, except it has a surface layer of gravelly sandy loam to loam 5 to 20 inches thick. The content of gravel ranges from 20 to 50 percent, but it is generally about 30 percent. The subsoil and substratum are also gravelly in some places.

Included with this soil in mapping is a small acreage of nongravelly soils and small areas of soils that have slopes of 6 to 10 percent. Also included in the mapping are areas of a soil that has a dark-colored surface layer less than 20 inches thick.

This soil retains 6 to 8 inches of available water. Runoff is medium, and the erosion hazard is moderate.

This soil is used for dryland wheat and for range in spring and fall. Capability unit IIIe-U, nonirrigated.

Riverwash

Riverwash (RV) is a miscellaneous land type that consists of beds of sediments deposited by rivers. It occurs in areas that are subject to flooding. The texture of the alluvium ranges from sandy to clayey. Gravel and cobblestones are dominant in some areas, but clayey material is dominant in other places.

This land supports little or no vegetation and has no farming value. Capability unit VIIIw-4, nonirrigated.

Rock Land

Rock land (RW) consists of barren rock and stony or cobbly material. About 60 to 80 percent of this mapping unit is rock outcrops, rock slides, or areas that have 3 to 5 inches of soil material over the rocks. The slopes range from gently sloping to almost perpendicular ledges or cliffs.

Included in mapping are areas of Pleasant Grove stony loam, 10 to 25 percent slopes and areas of Rake extremely stony loam, 20 to 70 percent slopes, eroded. Also included in the mapping, at the head of Fort Creek Canyon, is a small area of McPhie cobbly sandy loam, 20 to 60 percent slopes.

The vegetation consists only of trees and shrubs growing in the cracks of the rocks and in the talus material. Very little of the range forage produced is accessible to livestock for grazing. This land is used only for esthetic purposes, watersheds, and wildlife habitat. It has no value for farming. Capability unit VIIIs-X, nonirrigated.

Steed Series

The Steed series consists of well-drained, calcareous, gently sloping, very gravelly soils that occur mainly on the flood plain of the American Fork River, the Provo River, and Santaquin Creek near Santaquin. These soils formed in gravelly alluvium derived from limestone, sandstone, and quartzite.

Elevations range from 4,560 to 5,200 feet. The average annual precipitation ranges from 14 to 16 inches. These soils are usually moist, but they are dry in all parts at depths between 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 49° to 52° F. The frost-free period is 150 to 170 days.

In a typical profile the soil material is very dark grayish-brown, mildly alkaline, very friable, gravelly and very gravelly sandy loam to a depth of about 31 inches. Below this, is very dark grayish-brown, very gravelly or very cobbly loamy sand or sand.

The vegetation consists of big sagebrush, cottonwood, cheatgrass, and low shrubs.

The Steed soils are used for irrigated small grains, alfalfa, pasture, and orchards.

Representative profile of Steed gravelly sandy loam in an area of cottonwood trees and cheatgrass 1/2 mile east of the American Fork Cemetery near the American Fork River, at a point 1,500 feet east and 700 feet north of the SW. corner of section 12, T. 5 S., R. 1 E.:

A1--0 to 7 inches, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard, very friable, nonsticky, and slightly plastic; common fine roots; common medium pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.6); clear, smooth boundary.

C1--7 to 31 inches, grayish-brown (10YR 5/2) very gravelly coarse sandy loam that is marginal to loamy sand, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard, very friable, nonsticky, and slightly plastic; few medium roots; few, fine, interstitial pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.7); gradual, smooth boundary.

C2--31 to 41 inches, grayish-brown (10YR 5/2) very gravelly loamy sand, very dark grayish brown (10YR 3/2) when moist; single grain; loose when dry or moist, nonsticky, and nonplastic; few fine roots; few, fine, interstitial pores; strongly calcareous; lime is disseminated; mildly alkaline (pH 7.8); gradual, smooth boundary.

C3--41 to 60 inches, grayish-brown (10YR 5/2) very gravelly loamy sand, very dark grayish brown (10YR 3/2) when moist; single grain; loose when dry or moist, nonsticky, and nonplastic; few fine roots; no visible pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.0).

The A horizon is very dark grayish brown or dark brown. Below the A horizon, is very dark grayish brown to dark grayish brown or dark brown to brown loamy sand to sand with 50 to 80 percent coarse fragments. The reaction is mildly alkaline or moderately alkaline.

Steed gravelly sandy loam, (0 to 3 percent slopes) (Se).--A profile of this soil is the one described as typical of the series. Cobblestones and stones are on the surface in places.

Included with this soil in mapping are a few small areas of the poorly drained Provo gravelly fine sandy loam.

This Steed soil is well drained and is rapidly permeable. Roots generally penetrate to a depth of 5 feet or more, but the gravel and cobblestones in the substratum restrict root penetration in places. The soil holds between 2 and 3.5 inches of available water. Runoff is slow because most of the precipitation enters the soil. The erosion hazard is slight. Natural fertility is low. This soil is difficult to work because of the gravel on and in the soil.

This soil is used for irrigated pasture, for apple and cherry orchards, and for alfalfa, small grains, and range. Capability unit IVs-14, irrigated, and VIs-U4, nonirrigated.

Steed sandy loam (0 to 3 percent slopes) (Sd).--This soil is generally on the outer edges of alluvial fans. The surface layer lacks gravel, otherwise its profile is similar to that described as typical for the series. The depth to gravel and cobblestones ranges from 8 to 20 inches.

Included with this soil in mapping are areas of a soil that has a surface layer of light loam. Gravel is scattered over the surface in places.

This Steed soil holds about 3 inches of available water.

Most of the acreage is used for irrigated corn, small grains, alfalfa, improved pasture, and apple orchards. Capability unit IVs-14, irrigated.

Sterling Series

The Sterling series consists of calcareous, somewhat excessively drained, very gravelly soils, mainly on lake terraces or terrace escarpments on the Highland Bench. Slopes range from 1 to 70 percent. These soils formed in gravelly lake sediments derived mainly from limestone.

Elevations range from 4,600 to 5,000 feet. The average annual precipitation ranges from 14 to 16 inches. The soils are usually moist, but they are dry in all parts at depths between 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 49° to 52° F. The frost-free period is 150 to 170 days.

In a typical profile, the surface layer is very dark grayish-brown or dark-brown, moderately alkaline gravelly fine sandy loam about 11 inches thick. Below this is about 10 inches of brown, strongly calcareous, friable gravelly sandy loam or very gravelly sandy loam. At a depth of 21 inches is grayish-brown, strongly calcareous, very gravelly sand. Distinct layers of carbonate accumulation are below the surface layer.

The vegetation consists of big sagebrush, cheatgrass, western wheatgrass, and annual weeds.

The Sterling soils are used mainly for growing irrigated alfalfa, small grains, orchards, and pasture, but a small acreage is used for range.

Representative profile of Sterling gravelly fine sandy loam, 6 to 10 percent slopes, in an apple orchard about 1 mile northwest of American Fork city, at a point 425 feet east and 850 feet north of the SW. corner of section 10, T. 5 S., R. 1 E.:

Ap--0 to 5 inches, grayish-brown (10YR 5/2) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, platy structure that breaks to moderate, fine, granular; slightly hard, friable, slightly sticky, and slightly plastic; few fine and medium roots; few medium and fine pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.1); clear, smooth boundary.

A1--5 to 11 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular, blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; few fine and medium roots; few fine pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.2); gradual, smooth boundary.

C1ca--11 to 16 inches, pale-brown (10YR 6/3) gravelly sandy loam, brown (10YR 5/3) when moist; massive; slightly hard, friable, slightly sticky; and slightly plastic; few fine and

medium roots; few fine pores; strongly calcareous; lime is disseminated and also appears as coatings on coarse fragments; moderately alkaline (pH 8.0); gradual, wavy boundary.

C2ca--16 to 21 inches, pale-brown (10YR 6/3) very gravelly sandy loam, brown (10YR 5/3) when moist; massive; soft, very friable, slightly sticky, and nonplastic; few fine roots; no visible pores; strongly calcareous; lime is disseminated and also appears as coatings on gravel; moderately alkaline (pH 8.2); gradual, wavy boundary.

C3ca--21 to 60 inches, light brownish-gray (10YR 6/2) very gravelly sand (85 percent gravel), grayish brown (10YR 5/2) when moist; single grain; loose, nonsticky, and nonplastic; few fine roots; strongly calcareous; lime is disseminated and also appears as coatings on gravel; moderately alkaline (pH 8.4).

The A horizon is very dark grayish brown or very dark brown. The Cca horizon is grayish brown or brown and contains 50 to 60 percent gravel and cobblestones. The lime content of the Cca horizon ranges from 15 to 60 percent. The C horizon below a depth of 40 inches ranges from very cobbly loam to very cobbly sand, and the lime content is at least 5 percent less than in the Cca horizon. Reaction is mildly or moderately alkaline.

Sterling gravelly fine sandy loam, 1 to 3 percent slopes (SgB).--This soil is on lake terraces or benches. Its profile is similar to the one described as typical for the series. The content of gravel in the surface layer ranges from 15 to 25 percent.

Included with this soil in mapping are areas of a Sterling soil that does not contain lime in the surface layer. Also included in the mapping, about 1/2 mile north of the town of Salem, is an area of a soil that is mottled between a depth of 20 and 40 inches. Apparently it has a water table in some seasons. In the same area, the gravel content of its surface layer ranges from little to 20 percent.

This soil is somewhat excessively drained, and is rapidly permeable. The available water capacity is about 3.5 inches to a depth of 5 feet. Runoff is slow, and the erosion hazard is slight.

Most of this soil is used for irrigated small grains, alfalfa, pasture, and apple, cherry, peach, and pear orchards. Capability unit IVs-14, irrigated.

Sterling gravelly fine sandy loam, 3 to 6 percent slopes (SgC).--This moderately sloping soil is on terrace escarpments. It has a profile similar to the one described as typical for the series, except its surface layer is usually 2 or 3 inches thicker, and the gravel content is 20 to 35 percent.

This soil is somewhat excessively drained and is rapidly permeable. The available water capacity is about 3.5 inches to a depth of 5 feet. The erosion hazard is moderate.

This soil is used for apple, pear, peach, and cherry orchards and for irrigated small grains, alfalfa, and pasture. Capability unit IVs-14, irrigated.

Sterling gravelly fine sandy loam, 6 to 10 percent slopes (SgD).--A profile of this soil is the one described as typical of the series.

Included with this soil in mapping, about 1/2 mile south of the Manila Church at the base of the terrace escarpment, are a few acres of this soil where the water table fluctuates but is within 20 to 60 inches of the surface and the soil is mottled between a depth of 20 and 40 inches. Also included in the mapping are about 89 acres of low ridges and swales on a sloping lake terrace escarpment east of American Fork city; Sterling gravelly fine sandy loam 6 to 10 percent slopes, is on the ridges, which are 10 to 15 feet higher than the swales. Wet, unnamed soils are in the swales, and they make up about 15 percent of each area; excess irrigation water and rainwater accumulate in the swales.

This soil is somewhat excessively drained and is rapidly permeable. Root penetration is somewhat restricted below a depth of 20 to 30 inches by gravel and cobblestones. This soil holds about 3.5 inches of available water. Runoff is medium, and the erosion hazard is severe. The natural fertility is low. This soil is difficult to till because of the gravel content.

This soil is used for irrigated apple, pear, peach, and cherry orchards, alfalfa, small grains, and improved pasture. Areas that are not irrigated are used for range. Capability unit IVs-14, irrigated, and VIs-U4, nonirrigated.

Sterling-Terrace escarpments complex, 30 to 70 percent slopes (SNG).--This complex is on lake terrace escarpments. It occurs mainly at the mouth of canyons and is prominent at the mouth of the American Fork Canyon. About 60 percent of the complex is Sterling cobbly fine sandy loam, 30 to 70 percent slopes, and the rest is Terrace escarpments.

The Sterling soil has a profile similar to that described as typical for the series, except that the surface layer is 9 to 14 inches thick and the cobblestones and stones are common throughout. Terrace escarpments lack a distinct surface layer and commonly have cobblestones and stones on the surface.

This complex is used as range for livestock. Many sand and gravel pits also have been developed. Sterling soil in capability unit VIIs-UX4, nonirrigated; Terrace escarpments in capability unit VIIIs-4, nonirrigated.

Sunset Series

The Sunset series consists of deep, moderately well-drained, calcareous, nearly level to gently sloping soils, mainly on the flood plain of Dry Creek southeast of Lehi city and the Spanish Fork River near the towns of Palmyra, Lake Shore, and Benjamin. These soils formed in alluvium derived from limestone, shale, and granite.

Elevations range from 4,500 to 4,700 feet. The average annual precipitation ranges from 14 to 16

inches. These soils are dry in some parts between depths of 7 and 20 inches for more than 90 cumulative days in summer. The mean annual soil temperature is 49° or 50° F., and the frost-free period is 130 to 150 days.

In a typical profile, the surface layer is very dark grayish-brown light loam 14 inches thick. Below this is very dark grayish-brown to dark grayish-brown, friable, light loam or very fine sandy loam. Strata of silty clay loam is at a depth of 41 inches. Distinct mottles occur below a depth of 28 inches.

The vegetation is saltgrass, rubber rabbitbrush, western wheatgrass, and low shrubs.

The Sunset soils are moderately extensive in this survey area. They are used for irrigated pasture, sugar beets, small grains, alfalfa, and corn.

Representative profile or Sunset loam in a cornfield 1 mile south and 1 mile west of the city of Lehi, at a point 2,600 feet west and 660 feet south of the NE. corner of section 14, T. 5 S., R. 1 E.:

Ap--0 to 7 inches, grayish-brown (10YR 5/2) light loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular; slightly hard, friable, slightly sticky, and plastic; common fine roots; few fine pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.

A1--7 to 14 inches, grayish-brown (10YR 5/2) light loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular; hard, friable, slightly sticky, and plastic; few fine roots; few fine and medium pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.3); clear, smooth boundary.

C1--14 to 28 inches, grayish-brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard, very friable, nonsticky, and slightly plastic; few fine roots; common fine pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.2); clear, smooth boundary.

C2--28 to 34 inches, grayish-brown (10YR 5/2) light loam, very dark brown (10YR 2/2) when moist; common, fine, distinct, dark reddish-brown (5YR 3/4) mottles; massive, hard, friable, slightly sticky, and plastic; few fine roots; many fine and few medium pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.0); abrupt, smooth boundary.

C3--34 to 41 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) when moist; few, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; slightly hard, friable, slightly sticky, and plastic; few fine roots; many fine and few medium pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.1); abrupt, smooth boundary.

C4--41 to 48 inches, grayish-brown (10YR 5/2) silty clay loam, very dark brown (10YR 3/2) when moist; few, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; hard, firm, sticky, and plastic; few fine roots; many fine and few medium pores; slightly calcareous; lime is disseminated; moderately alkaline (pH 7.9); clear, smooth boundary.

C5--48 to 60 inches, light brownish-gray (10YR 6/2) light loam, very dark grayish brown (10YR 3/2) when moist; masssive; hard, friable, slightly sticky, and plastic; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.0).

The A horizon is very dark grayish brown to dark grayish brown or very dark brown to dark brown loam to loamy fine sand. The C horizon is very dark grayish brown to brown very fine sandy loam or light loam to silty clay loam that contains less than 18 percent clay and more than 15 percent sand that is coarser than very fine sand. Mottles occur at some depth between 20 and 40 inches. The water table ranges from 40 to 60 inches below the surface. Reaction is mildly to moderately alkaline in the A horizon.

Sunset loam (0 to 3 percent slopes) (Sr).--A profile of this soil is the one described as typical of the series. The substratum is commonly stratified loam to silt loam to sandy loam. The water table is below a depth of 40 inches in most places, but mottles occur between a depth of 20 and 40 inches.

Included with this soil in mapping, about 2 miles northwest of Payson, is a small area of a soil that has a dark-gray surface layer 8 to 12 inches thick and a small area, north of Hobble Creek and about 1/2 mile west of D&RGW railroad tracks, of a soil that has an overwash of loamy fine sand as much as 12 inches thick. Narrow streaks of gravel, 5 to 15 feet wide, are common in areas south and west of Lehi city. In some places, gravel and sand occur below a depth of 30 inches. Also included in the mapping are a few small areas of soils that have a surface layer of silty clay loam or very fine sandy loam.

This soil is moderately well drained and is moderately permeable. Roots penetrate easily to a depth of 4 feet, but root penetration of some plants is restricted to that depth by the water table. This soil holds between 9 and 11 inches of available water. Runoff is slow because most of the precipitation enters the soil. There is no erosion hazard. Natural fertility is high. This soil has good tilth and is easy to work.

This soil is used for irrigated alfalfa, small grains, corn, sugar beets, and pasture. Capability unit IIw-2, irrigated.

Sunset loam, clay substratum (0 to 1 percent slopes) (St).--This soil has a profile similar to that described as typical for the series, except that below a depth of 30 inches there are layers of clay 12 to 30 inches thick. This soil is more

difficult to drain than Sunset loam because of the slow permeability of the clay layers.

Included with this soil in mapping are a few small areas that lack the clay layers of this soil. Also included in the mapping are a few places that have a surface layer of silty clay loam.

This Sunset soil is moderately well drained and is slowly permeable. It holds about 9 to 11 inches of available water. Runoff is slow, and the erosion hazard is none to slight.

This soil is used for irrigated crops of alfalfa, sugar beets, small grains, pasture, and corn. Drains have been installed in most areas but they are needed in some other places. Capability unit IIw-2, irrigated.

Sunset loam, gravelly substratum (0 to 1 percent slopes) (Ss).--This soil is on alluvial fans and flood plains. Except for the gravelly sandy loam to loamy sand between a depth of 20 and 60 inches, its profile is similar to that described as typical for the series.

Included with this soil in mapping are areas that have gravel on the surface, and also areas, making up about 25 percent of the mapping unit, in which no gravel is within 5 feet of the surface.

The layer of gravel below a depth of 20 inches makes this soil easier to drain than Sunset loam, and tile drains can be spaced farther apart. This soil holds between 6 and 7.5 inches of available water, depending on the depth to the gravel.

This soil is used for irrigated alfalfa, small grains, corn, sugar beets, and pasture. Capability unit IIw-2, irrigated.

Sunset loam, moderately saline (0 to 1 percent slopes) (Su).--This soil occurs on flood plains, mainly in the general area of Palmyra, Lake Shore, and Benjamin. It is moderately saline, otherwise its profile is similar to that described as typical for the series. About half of the acreage of this soil has a clay layer in the substratum; this layer is 6 to 30 inches thick, is at a depth of more than 20 inches, and commonly has a perched water table at the top.

The salt content of this soil reduces the amount of water available to plants to about 7 inches.

Included with this soil in mapping are small spots of strongly saline-alkali soils and some areas of nonsaline-alkali soils. Also included in the mapping are small areas of Kirkham silty clay loam.

This Sunset soil is used mainly for alfalfa, barley, sugar beets, and improved pasture, but some areas are used for dryland pasture of tall wheatgrass. Capability unit IIIw-27, irrigated.

Sunset loamy fine sand (0 to 1 percent) (So).--This soil is adjacent to the Spanish Fork River between the old sugar factory and the tracks of the Union Pacific Railroad. The railroad tracks are about 10 feet higher than the flood plain and a narrow bridge is over the river. In 1952 the Spanish Fork River reached flood stage and the railroad grade acted as a dam and a considerable amount of sandy sediments were deposited on the surface of the Sunset soil. The profile of this soil is similar to that described as typical for the series, except that it has an overwash of loamy fine sand 3 to 24 inches thick. The overwash is thickest near the railroad tracks and is thinner upstream.

This soil is typically moderately saline-alkali, but in places it is strongly saline-alkali. It is moderately well drained and has a water table at a depth of 40 to 60 inches. The soil holds only about 6 inches of available water because of the high salt content.

Most of this soil produces saltgrass pasture. Some areas have been seeded to tall wheatgrass, and some areas are used for irrigated barley, pasture, alfalfa, and sugar beets. Capability unit IVw-24, irrigated.

Taylorsville Series

The Taylorsville series consists of deep, well-drained soils on lake terraces, mainly around Lehi city and north of Payson city. Slopes range from 0 to 20 percent. These soils formed in calcareous, moderately fine textured lake sediments derived from limestone and shale.

Elevations range from 4,500 to 4,900 feet. The average annual precipitation ranges from 14 to 16 inches. The soils are usually moist, but they are dry in all parts at a depth between 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 49° to 52° F., and the frost-free period ranges from 130 to 170 days.

In a typical profile, dark grayish-brown, moderately alkaline, moderately calcareous silty clay loam extends from the surface to a depth of about 13 inches. Below this is dark grayish-brown or grayish-brown, strongly calcareous silty clay loam. A distinct layer of lime is at a depth of about 36 inches.

The vegetation is big sagebrush and western wheatgrass.

Taylorsville soils are moderately extensive in this survey area. They are used mainly for growing irrigated alfalfa, small grains, corn, sugar beets, and pasture and for apple orchards in a few places.

Representative profile of Taylorsville silty clay loam, 1 to 3 percent slopes, in a plowed field about 3 miles northwest of Lehi city, at a point 2,640 feet north and 1,700 feet west of the SE. corner of section 36, T. 4 S., R. 1 E.:

Ap--0 to 7 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky, and plastic; few fine and medium roots; common fine and few medium pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 7.9); abrupt, smooth boundary.

AC--7 to 13 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular; hard, firm, slightly sticky, and plastic; few fine roots; common medium and fine pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.1); clear, wavy boundary.

C1--13 to 27 inches, light-gray (10YR 7/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky, and plastic; few fine roots; common fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.1); gradual, wavy boundary.

C2--27 to 36 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; very hard, firm, sticky, and plastic; few fine roots; common fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.2); gradual, wavy boundary.

C3ca--36 to 56 inches, light-gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) when moist; massive; hard, firm, sticky, and plastic; no roots; common fine pores; very strongly calcareous; strongly alkaline (pH 8.7); gradual, wavy boundary.

C4--56 to 62 inches, very pale-brown (10YR 8/3) silty clay loam, grayish brown (10YR 5/2) when moist; common, medium, distinct, olive-brown (2.5Y 4/4) mottles; massive; hard, firm, sticky, and plastic; no visible roots; few fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.4).

The A horizon is 8 to 18 inches thick. The soil ranges from dark grayish brown to grayish brown if it is not mottled. If mottled, it is brown or dark brown. The soil material is moderately to strongly calcareous. Reaction is mildly alkaline to strongly alkaline. The A horizon and the upper part of the C horizon range from heavy silt loam to silty clay loam that is 25 to 33 percent clay and less than 15 percent sand coarser than very fine sand. Below a depth of 40 inches, the texture ranges from silty clay to sandy loam consisting of typically laminated, calcareous, lacustrine sediments with marked vertical jointing.

Taylorsville silty clay loam, 0 to 1 percent slopes (TaA).--This soil is on low lake terraces. Its profile is similar to the one described as typical for the series.

Included with this soil in mapping, about 1/4 mile south of the Payson railroad station, are about 20 acres of a soil that has a surface layer of loamy fine sand 6 to 20 inches thick. Also included in the mapping are small areas of the somewhat poorly drained Bramwell soils. Other inclusions, in a small basin-like area 1/4 mile east of the Kiegley Quarry, is a small acreage of an unnamed soil that has a surface layer of dark grayish-brown silty clay loam 8 to 30 inches thick and a reddish-brown subsoil of silty clay loam that is not typical of Taylorsville soils.

This soil is only moderately well drained in places. The water table occurs at a depth of 40 to 60 inches, and the soil is mottled in some places. The erosion hazard is moderate.

This soil is used for irrigated alfalfa, small grains, pasture, corn, and sugar beets. The frost-free period is 130 to 150 days. Capability unit IIIe-25, irrigated.

Taylorsville silty clay loam, 1 to 3 percent slopes (TaB).--A profile of this soil is the one described as typical of the series. The surface layer is only slightly calcareous in a few places.

Included with this soil in mapping are a few small areas that have a gravelly surface layer and in places that have gravel below a depth of 30 inches. Also included in the mapping are small areas of Bramwell soils.

This soil is well drained and is slowly permeable. Roots penetrate to a depth of 5 feet or more. The soil retains about 11 inches of available water in the rooting zone. Runoff is slow, and the erosion hazard is moderate. Natural fertility is moderate. This soil is somewhat difficult to till. It can be cultivated satisfactorily without compacting only if the moisture content is less than 40 percent of field capacity. A seedbed is easier to prepare in fall than in spring.

This soil is used for growing irrigated alfalfa, small grains, pasture, corn, and sugar beets. The frost-free period is 130 to 150 days. Capability unit IIIe-25, irrigated.

Taylorsville silty clay loam, extended season, 0 to 1 percent slopes (TcA).--This soil is on lake terraces at an elevation of more than 4,700 feet. Its profile is similar to the one described as typical for the series. The frost-free period is 150 to 170 days. The erosion hazard is moderate.

Most of the acreage is used mainly to grow alfalfa, corn, pasture, small grains, and sugar beets, but there are a few apple orchards. Capability unit IIIe-25, irrigated.

Taylorsville silty clay loam, extended season, 1 to 3 percent slopes (TcB).--This soil is on lake terraces at an elevation of more than 4,700 feet. Its profile is similar to the one described as typical for the series. The frost-free period is 150 to 170 days. Except for the longer growing season, this soil is similar to Taylorsville silty clay loam, 1 to 3 percent slopes, and it is used and managed in about the same way. On the Highland Bench north of the Manila Church, are a few sink holes and cavities. Linings in canals crack and break up because the soil is unstable. Apparently the high silt content of this soil causes the low stability.

This soil is used mainly to grow irrigated small grains, corn, alfalfa, pasture, and sugar beets, but

dryland wheat and a few apple orchards are also grown. Capability units IIIe-25, irrigated, and IIIe-U, nonirrigated.

Taylorsville silty clay loam, extended season, 3 to 6 percent slopes, eroded (TcC2).--This soil is on lake terraces. It has a profile similar to the one described as typical for the series. The surface layer is about 7 inches thick. On some of the ridges and steeper slopes, erosion has removed the original surface soil and the present surface layer is brownish-gray material. The frost-free period is 150 to 170 days.

Included with this soil in mapping are some areas of soils having slopes of 6 to 15 percent.

Runoff is medium, and the erosion hazard is severe.

This soil is used mainly for dryland wheat, alfalfa, or pasture. Capability unit IIIe-U, nonirrigated.

Timpanogos Series

The Timpanogos series consists of deep, well-drained, and moderately well drained soils. They are on lake terraces on the Highland, Orem, and Mapleton Benches and are near the town of Salem. Slopes range from 0 to 6 percent. These soils formed in lake sediments derived from quartzite, limestone, and granite.

Elevations range from 4,700 to 4,900 feet. The average annual precipitation ranges from 15 to 18 inches. The soils are usually moist but are dry in all parts at depths between 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature is 49° to 52° F., and the frost-free period is 150 to 170 days.

In a typical profile, the surface layer is very dark grayish-brown, neutral loam about 9 inches thick. The subsoil is dark-brown to brown, mildly alkaline, firm heavy loam about 9 inches thick. The substratum is brown, moderately or strongly calcareous, moderately alkaline, friable silt loam.

The vegetation is big sagebrush, brushy Gambel oak, and bluebunch wheatgrass.

Timpanogos soils are used for growing irrigated crops of alfalfa, sugar beets, small grains, corn, pasture, and orchards.

Representative profile of Timpanogos loam, 0 to 3 percent slopes, in a pasture 1 mile west of the Highland Ward Church, at a point 2,740 feet west and 300 feet south of the NE. corner of section 3, T. 5 S., R. 1 E.:

Ap--0 to 9 inches, grayish-brown (10YR 5/2) light loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; hard, friable, slightly sticky, and slightly plastic; few medium and many fine and very fine roots; few fine and common very fine, discontinuous pores; slightly calcareous; neutral (pH 7.3); clear, smooth boundary.

B2t--9 to 14 inches, brown (10YR 5/3) heavy loam, dark brown (10YR 3/3) when moist; moderate, medium, angular blocky structure; hard, firm, slightly sticky, and plastic; few medium and common fine and very fine roots; many very fine, discontinuous pores, common thin clay films; noncalcareous; mildly alkaline (pH 7.5); clear, smooth boundary.

B3ca--14 to 18 inches, pale-brown (10YR 6/3) heavy loam, brown (10YR 6/3) when moist; weak, fine, subangular blocky structure; hard, firm, slightly sticky, and plastic; few fine roots; few fine and many, very fine, discontinuous pores; few thin clay films; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.7); gradual, smooth boundary.

C1ca--18 to 30 inches, pale-brown (10YR 6/3) light silt loam, brown (10YR 5/3) when moist; massive; hard, friable, nonsticky, and slightly plastic; few very fine roots; few fine and many, very fine, discontinuous pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.0); gradual, wavy boundary.

C2ca--30 to 48 inches, pale-brown (10YR 6/3) light silt loam, brown (10YR 5/3) when moist; massive; hard, friable, nonsticky, and slightly plastic; few very fine roots; few fine and many, very fine, discontinuous pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.

IIC3--48 to 60 inches, pale-brown (10YR 6/3) gravelly loamy coarse sand, brown (10YR 4/3) when moist; single grain; loose when dry and moist, nonsticky, and nonplastic; no roots; no discernible pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.0).

The A horizon ranges from very dark brown to dark brown or very dark grayish brown and from 7 to 10 inches in thickness. The B2 horizon is similar in color to the A horizon. Its texture is heavy loam or silt loam that contains more than 18 percent clay and more than 15 percent sand coarser than very fine sand. The B3ca horizon is dark grayish-brown to brown, moderately to strongly calcareous, heavy loam or silt loam. The Cca horizon is dark grayish brown to light grayish brown or brown to pale brown loam, silt loam, or very fine sandy loam that may range to gravelly loamy sand or sand below a depth of 4 feet. The A and B horizons are neutral to mildly alkaline. Most of the Timpanogos soils that are irrigated by the Strawberry Irrigation System have calcareous A and B horizon because the water contains carbonates.

Timpanogos loam, 0 to 3 percent slopes (TmB).--A profile of this soil is the one described as typical of the series. The surface layer ranges from 7 to 10 inches in thickness. Some fine gravel is on the surface in places, and gravel and sand is commonly below a depth of 45 inches. The surface layer and subsoil are slightly calcareous in places.

Included with this soil in mapping are small areas of a Kidman very fine sandy loam and of Parleys soils. Also included, in places near the foothills, are areas that have 8 to 10 inches of gravelly sandy loam overwash.

This soil is well drained and is moderately permeable. Roots penetrate to a depth of 5 feet or more. The soil holds about 11 inches of available water. Runoff is slow, and the erosion hazard is slight. Natural fertility is high. This soil has good tilth and is easy to work.

This soil is used for irrigated small grains, alfalfa, corn, sugar beets, and pasture and peach, apple, cherry, and pear orchards. Capability unit I-1, irrigated.

Timpanogos loam, 3 to 6 percent slopes (TmC).--This soil is on lake terraces, mainly on rolling hills in the dryland farm areas, and it occupies the bottoms of narrow valleys where water runs from higher areas and provides additional moisture. Its profile is similar to that described as typical for the series. The slope gradient is mainly 3 or 4 percent.

Included with this soil in mapping are some small areas of Parleys soils that have a silty clay loam subsoil and of similar Welby soils that are calcareous throughout.

This soil is well drained and is moderately permeable. The available water is about 11 inches to a depth of 5 feet. Surface runoff is medium, and the erosion hazard is moderate.

This soil is used for dryland wheat and for irrigated alfalfa, small grains, and pasture and apple, peach, cherry, and pear orchards. Capability units IIe-1, irrigated, and IIIe-U, nonirrigated.

Timpanogos loam, water table, 0 to 3 percent slopes (ToB).--This soil is moderately well drained. Typically, the water table is between a depth of 40 and 60 inches, but in some seasons it is within 20 to 40 inches of the surface and, near the town of Mapleton, it is at a depth of 50 to 60 inches. Mottles occur at some depth between 20 and 40 inches. Except for the mottles, the profile of this soil is similar to that described as typical for the series. The surface layer and subsoil are slightly calcareous in places, especially in the area between the town of Salem and Payson city.

Included with this soil in mapping are small areas of Welby soils that are calcareous throughout the profile.

This soil is used for irrigated corn, small grains, alfalfa, pasture, and sugar beets. Capability unit I-1, irrigated.

Vineyard Series

The Vineyard series consists of deep, somewhat poorly drained, calcareous, nearly level and gently sloping soils. These soils occur on low lake terraces, near the cities of Lehi and Payson and the towns of Salem and Vineyard. They formed in lake sediments derived from sandstone, limestone, and quartzite.

Elevations range from 4,490 to 4,700 feet. The average annual precipitation is 14 to 16 inches. These soils are dry in some subhorizons at depths between 7 and 20 inches for more than 90 cumulative days in summer. The mean annual soil temperature is 49° to 50° F. The frost-free period is 130 to 150 days.

In a typical profile, the surface layer is very dark grayish-brown or dark grayish-brown, moderately alkaline, fine sandy loam about 13 inches thick. Between a depth of 13 and 35 inches, is grayish-brown to light brownish-gray, strongly calcareous, very fine sandy loam. These soils have a distinct calcareous layer beginning at a depth of about 13 inches, but the greatest concentration of carbonate is below a depth of 16 inches.

The vegetation consists of saltgrass, dandelion, Kentucky bluegrass, poverty weed, and annual weeds and grasses.

The Vineyard soils are used for irrigated crops of alfalfa, corn, sugar beets, and small grains and pasture.

Representative profile of Vineyard fine sandy loam, 0 to 2 percent slopes, in a cornfield 1/4 mile northwest of the town of Salem, at a point 1,400 feet west and 1,200 feet north of the SE. corner of section 2, T. 9 S., R. 2 E.:

Ap--0 to 7 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; hard, friable, nonsticky, and slightly plastic; common fine roots; few very fine pores; slightly calcareous; lime is disseminated; moderately alkaline (pH 8.3); clear, smooth boundary.

AC--7 to 13 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, subangular blocky structure; hard, friable, slightly sticky, and slightly plastic; few very fine roots; few medium and common, very fine, discontinuous pores; moderately calcareous; lime is disseminated; moderate alkaline (pH 8.4); gradual, wavy boundary.

C1ca--13 to 24 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; few very fine roots; few medium and common, very fine, discontinuous pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.6); gradual, smooth boundary.

C2ca--24 to 35 inches, white (10YR 8/2) fine sandy loam, light brownish gray (10YR 6/2) when moist; few, coarse, faint, brown (10YR 5/3) mottles; massive; slightly hard, friable, slightly sticky, and slightly plastic; few very fine and few fine roots; common, very fine, discontinuous pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 8.5); gradual, smooth boundary.

C3ca--35 to 42 inches, white (10YR 8/2) very fine sandy loam, light brownish gray (10YR 6/2) when moist; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; massive;

slightly hard, friable, nonsticky, and slightly plastic; no roots; common, very fine, discontinuous pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.4); gradual, wavy boundary.

C4--42 to 60 inches, light-gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) when moist; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; slightly hard, friable, nonsticky, and nonplastic; no roots or pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.4).

These soils are moderately to strongly alkaline and nonsaline to moderately saline. The A1 horizon is slightly to moderately calcareous. The lime content of the Cca horizon ranges from 15 to 40 percent. The C horizon, to a depth of 40 inches, is fine sandy loam to very fine sandy loam and contains less than 18 percent clay and more than 15 percent sand coarser than very fine sand. Below a depth of 40 inches, the C horizon ranges from sandy loam to silty clay loam. Depth to the water table is 30 to 60 inches. Mottles occur at some depth between 20 and 30 inches.

Vineyard fine sandy loam, 0 to 2 percent slopes (VnA).--A profile of this soil is the one described as typical of the series. This soil is usually in areas of moderate size, but it occurs in some large areas near the town of Salem.

Included with this soil in mapping are some areas that have a loam surface layer, and some areas especially about 1/2 mile north of Salem, that have a weakly cemented lime hardpan between a depth of 15 and 30 inches. Also included in the mapping are small areas of an unnamed soil that is similar to this soil but that has a loam or silt loam subsoil. Other inclusions are some areas of the well-drained Welby or Timpanogos soils.

This soil is somewhat poorly drained and is moderately rapidly permeable. Roots penetrate to a depth of 5 feet, but in places root penetration is restricted by the water table below a depth of 3 feet. Runoff is slow, and the erosion hazard is slight. Natural fertility is moderate. This soil is easy to work and to cultivate. It holds about 8 inches of available water.

Most of the acreage is used for irrigated pasture, alfalfa, corn, sugar beets, and small grains. Most areas have been improved by drains. Capability unit IIw-2, irrigated.

Vineyard fine sandy loam, moderately saline, 0 to 2 percent slopes (VsA).--This soil is moderately saline, otherwise its profile is similar to the one described as typical for the series. This soil holds only about 5 inches of water available for plants because of its high salt content. Natural fertility is moderate.

Irrigated pasture, barley, alfalfa, and sugar beets are grown on this soil, but most of the acreage is pasture consisting mainly of saltgrass. Capability unit IIIw-27, irrigated.

Welby Series

The Welby series consists of deep, well-drained, calcareous soils on lake terraces in the vicinity of the town of Alpine and Lehi city and south of the town of Salem. Slopes range from 0 to 20 percent. These soils developed in mixed lake sediments derived from sandstone, limestone, and shale.

Elevations range from 4,500 to 5,200 feet. The average annual precipitation ranges from 14 to 16 inches. These soils are usually moist, but they are dry in all parts between depths of 7 and 20 inches for more than 60 consecutive days in summer. The mean annual soil temperature ranges from 49° to 52° F. The frost-free period is 130 to 170 days.

In a typical profile, the surface layer is dark-brown, moderately alkaline silt loam or loam about 22 inches thick. Below this is brown, moderately alkaline, friable silt loam or loam. A layer in which lime has accumulated occurs at a depth of about 22 inches, and in some places below a depth of 16 inches.

The vegetation consists of big sagebrush, rubber rabbitbrush, western wheatgrass, and other perennial grasses.

The Welby soils are used for irrigated alfalfa, corn, small grains, sugar beets, pasture, and orchards. They are also used for dryland alfalfa and wheat.

Representative profile of Welby silt loam, 0 to 1 percent slopes, in a cultivated field 1 1/2 miles west and 1 1/4 miles north of Lehi city at a point 1,900 feet west and 230 feet south of the NE. corner of section 12, T. 5 S., R. 1 W.:

Ap--0 to 7 inches, brown (10YR 5/3) light silt loam, dark brown (10YR 3/3) when moist; weak, medium and fine, subangular blocky structure; hard, friable, nonsticky, and slightly plastic; common fine and few medium roots; few fine and few medium pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.1); clear, smooth boundary.

A1--7 to 12 inches, brown (10YR 5/3) light loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; hard, friable, nonsticky, and slightly plastic; few fine and few medium roots; few fine pores; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.1); clear, smooth boundary.

AC--12 to 22 inches, pale-brown (10YR 6/3) light silt loam, dark brown (10YR 4/3) when moist; massive; slightly hard, friable, nonsticky, and slightly plastic; few fine and medium roots; common fine and common medium pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.2); gradual, smooth boundary.

C1ca--22 to 40 inches, pale-brown (10YR 6/3) light silt loam, brown (10YR 5/3) when moist; massive;

slightly hard, friable, nonsticky, and slightly plastic; few fine and few medium roots; many fine and few medium pores; strongly calcareous; lime is disseminated and in veins; mildly alkaline (pH 7.7); diffuse, wavy boundary.

C2ca--40 to 54 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; massive; soft, friable, nonsticky, and slightly plastic; few fine roots; few fine and few medium pores; strongly calcareous; lime is disseminated and in fine veins or threads of segregated lime; moderately alkaline (pH 8.0); diffuse, wavy boundary.

C3--54 to 65 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; few, fine, faint, dark yellowish-brown (10YR 3/4) mottles; massive; slightly hard, friable, nonsticky, and slightly plastic; few fine roots; common fine pores; strongly calcareous; lime is disseminated; moderately alkaline (pH 8.0); diffuse, wavy boundary.

The A and C horizons are dark grayish brown to grayish brown or brown loam or silt loam that contain less than 18 percent clay and less than 15 percent fine sand or coarser sand. The Cca horizon is 15 to 40 percent lime. Sandy loam to silty clay loam is below a depth of 40 inches. The reaction ranges from mildly to strongly alkaline.

Welby silt loam, 0 to 1 percent slopes (WbA).--A profile of this soil is the one described as typical of the series. The surface layer ranges from 7 to 18 inches in thickness, but it is generally about 12 inches thick. In some places, especially in noncultivated areas, the soil material is noncalcareous in the uppermost 4 to 6 inches, but in adjoining cultivated areas the surface layer is calcareous.

Included with this soil in mapping are a few small areas of a Taylorsville silty clay loam and of a Vineyard fine sandy loam.

This Welby soil is well drained and is moderately permeable. Roots penetrate to a depth of 5 feet or more. The soil retains about 11 inches of available water. Runoff is slow, and the erosion hazard is none to slight. The natural fertility is medium, and the soil is easy to cultivate.

This soil is used for irrigated corn, pasture, sugar beets, and small grain. The frost-free period is 130 to 150 days. Capability unit IIc-2, irrigated.

Welby silt loam, 1 to 3 percent slopes (WbB).--This gently sloping soil is on low lake terraces. Its profile is similar to that described as typical for the series. Because of the slope, the erosion hazard is slight. North of the headquarters of the Bamberger Ranch, faint mottles occur at a depth of 36 inches or more. Apparently the mottles are related to a water table, but no water table exists now.

This soil is well drained and is moderately permeable. It holds about 11 inches of available water to a depth of 5 feet.

This soil is used for irrigated alfalfa, small grains, corn, pasture, and sugar beets. The frost-free period is 130 to 150 days. Capability unit IIe-2, irrigated.

Welby silt loam, 3 to 6 percent slopes (WbC).--This soil is on lake terraces. Its profile is similar to that described as typical for the series. The surface layer is from 7 to 12 inches thick. Gravel occurs at a depth of more than 30 inches in some places, especially along the eastern edge of West Mountain.

Included with this soil in mapping are some small areas of a Taylorsville silty clay loam.

This soil is well drained and is moderately permeable. The available water is about 11 inches to a depth of 5 feet. Runoff is medium, and the erosion hazard is moderate.

This soil is used for irrigated alfalfa, small grains, and improved pasture. Slopes are too steep for row crops. The frost-free period is 130 to 150 days. Capability unit IIIe-1, irrigated.

Welby silt loam, extended season, 0 to 1 percent slopes (WeA).--This soil is on high lake terraces, in an area where the frost-free period is 150 to 170 days. It has a profile similar to that described as typical for the series. Sand and gravel are at a depth of more than 30 inches in places.

Included with this soil in mapping are small areas of Timpanogos soils.

This Welby soil is well drained and is moderately permeable. It holds about 11 inches of available water to a depth of 5 feet. Runoff is slow, and the erosion hazard is none to slight. Roots penetrate to a depth of 5 feet or more.

This soil is used for growing irrigated alfalfa, small grains, pasture, corn, sugar beets, and apple, cherry, pear, and peach orchards. Capability unit I-1, irrigated.

Welby silt loam, extended season, 1 to 3 percent slopes (WeB).--This soil is on high lake terraces where the frost-free period is 150 to 170 days. Its profile is similar to that described as typical for the series. Sand and gravel are at a depth of more than 24 inches in places.

Included with this soil in mapping are small areas of soils having slopes of less than 1 percent. Also included are small areas of Timpanogos soils.

This soil is well drained and is moderately permeable. Runoff is medium, and the erosion hazard is slight. The soil holds about 11 inches of available water to a depth of 5 feet.

This soil is used for irrigated alfalfa, small grain, pasture, corn, and sugar beets, and in a few places for dryland wheat. Peach, cherry, apple, and pear orchards are also grown. Capability units IIe-1, irrigated, and IIIe-U, nonirrigated.

An area of Mixed alluvial land, saline, near the mouth of the Spanish Fork River. This land has crusts of salt on the surface. It is usually bare, but there is a sparse growth of pickleweed and samphire in places.

Orchards on Bingham gravelly loam, 1 to 3 percent slopes. This soil is used for apple, cherry, and peach orchards.

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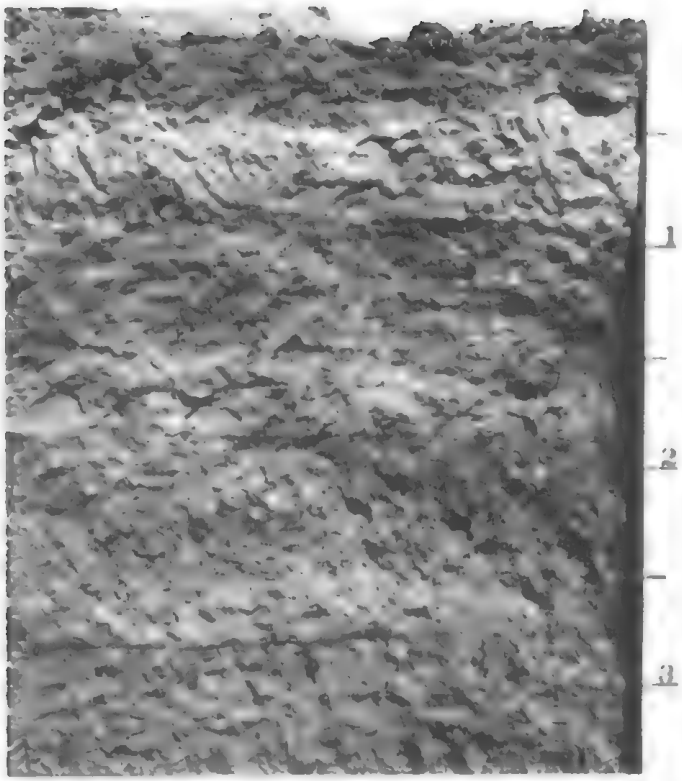
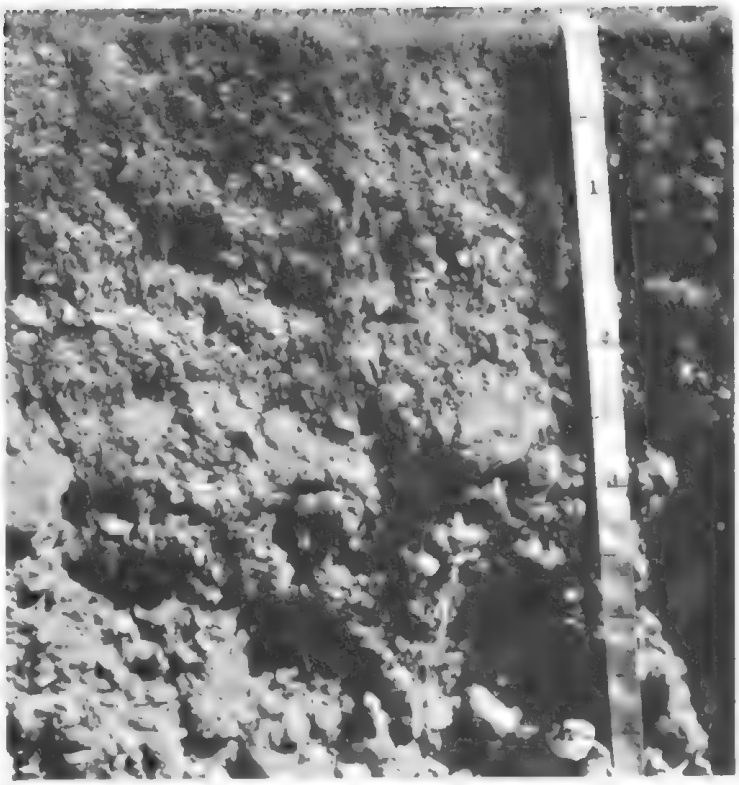
Profile of Bingham gravelly loam, 1 to 3 percent slopes.

Profile of Layton fine sandy loam, water table, 1 to 3 percent slopes. A calcareous layer begins at a depth of about 26 inches.

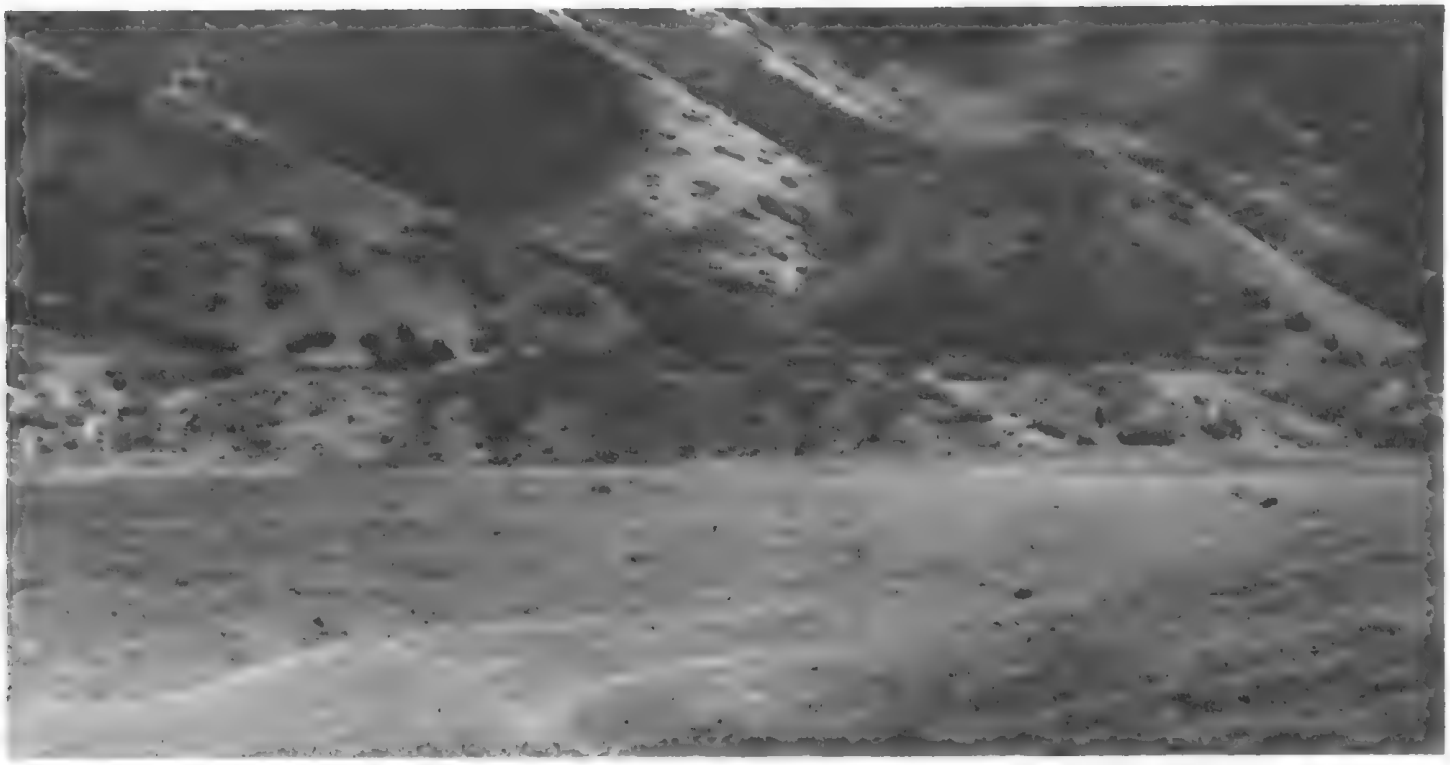
Hillfield - Layton complex, 30 to 60 percent slopes, near Orem. Right: Hillfield silt loam occupies the west-facing slopes. Left: Layton soils are on slopes that face north.



Profile of Mixed alluvial land. The surface layer is silt loam about 6 inches thick. The next layer, about 6 inches thick, is loamy sand. Below this is about 12 inches of silt loam. Silty clay loam is between a depth of 24 and 30 inches.



Profile of Pleasant Grove stony loam, 10 to 25 percent slopes, eroded. Below a depth of 48 inches, the gravel and cobblestones are rounded, well sorted, and aligned, which indicates deposition in water. The cobblestones and gravel are angular and occur in no definite pattern.



Cultivated areas of McMurdie-Taylorsville complex, 6 to 20 percent slopes, eroded. The McMurdie soils are in the less sloping areas and in the drainageways. The Taylorsville soils are on the ridges and steeper slopes.

An area of a Pleasant Grove soil and Terrace escarpments.

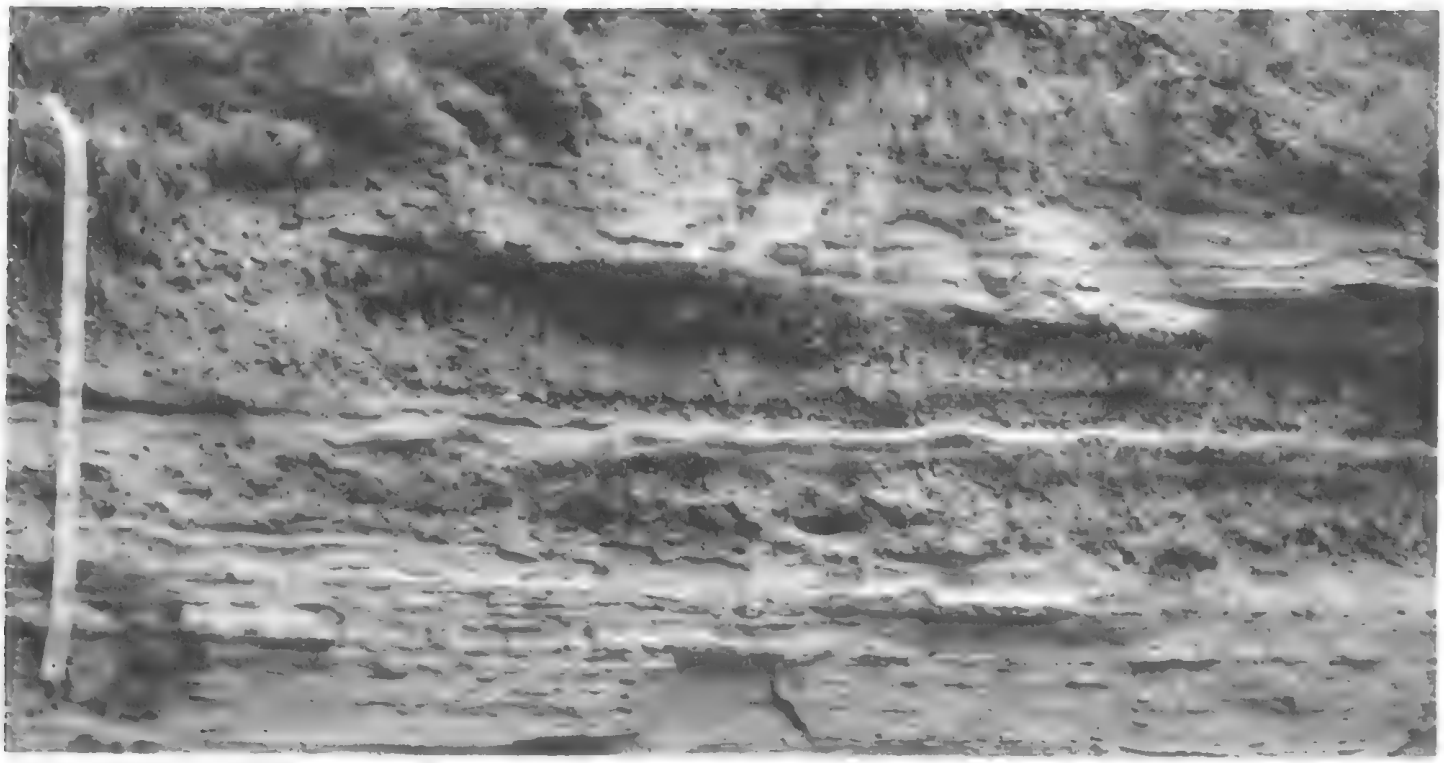
Small grain, alfalfa, and corn on Parleys loam, 0 to 3 percent slopes.

Peach orchard on Parleys loam, 3 to 6 percent slopes, on a high lake terrace where the elevation is 5,000 feet.

An area of Payson–Terrace escarpments complex, 1 to 20 percent slopes. The Payson soils occupy the nearly level terraces. Greasewood is the dominant vegetation. The nearly barren Terrace escarpments are in the background.

Preston fine sand, 1 to 10 percent slopes. Material has been removed from this area to be used for road construction.

Pleasant Grove stony loam, 10 to 25 percent slopes, eroded, overlying lake sediments. Above the stone line is the Pleasant Grove soil that formed in alluvium and colluvium from the slopes above. Below the stone line, indicated by arrows, are the laminated lake sediments. This bank is 15 feet high.



Laminated lake sediments near Orem city cemetery.

Layton loamy fine sand, 6 to 15 percent slopes on a lacustrine terrace on the Bonneville level near Mapleton. Preston fine sand, 1 to 10 percent slopes, occupies the outer edges of the terrace on the right.

Welby silt loam, extended season, 3 to 6 percent slopes (WeC).--This soil is on high lake terraces where the frost-free period is 150 to 170 days. Its profile is similar to that described as typical for the series. Because of the slope, runoff is medium and the erosion hazard is moderate. Gravel is at a depth of more than 24 to 30 inches in places, but along the eastern edge of West Mountain, gravel is at a depth of more than 30 inches in many places.

Included with this soil in mapping are small areas of soils that are gravelly throughout. About 1/4 mile west of the town of Spring Lake are about 40 acres of fine sandy loam. This acreage occurs as a long, narrow strip.

This soil is used for dryland wheat and alfalfa, and also for irrigated small grains, alfalfa, and pasture and apple, peach, pear, and cherry orchards. Capability units IIIe-1, irrigated, and IIIe-U, nonirrigated.

Welby silt loam, extended season, 6 to 10 percent slopes, eroded (WeD2).--This soil occurs in small to medium areas on lake terraces, where the frost-free period is 150 to 170 days. Its profile is similar to that described as typical for the series. The surface layer is 7 to 10 inches thick.

Included with this soil in mapping are a few areas that have a surface layer of sandy loam. Also included are small areas of Timpanogos soils and small areas of Hillfield soils.

Runoff is medium, and the erosion hazard is severe. Sheet erosion is active, and rills and shallow gullies occur in places.

Most of this soil is used for dryland wheat and alfalfa, but small irrigated areas are used for alfalfa and small grains. Capability unit IIIe-U, nonirrigated.

Welby-Hillfield silt loams, 6 to 10 percent slopes (WhD).--This mapping unit is on rolling lake terraces, in an area west of the town of Alpine and in an area south of the town of Salem. About 60 percent of the complex is Welby silt loam, extended season, 6 to 10 percent slopes, eroded, and 40 percent is Hillfield silt loam, 6 to 10 percent slopes. The Welby soil is on the north- and east-facing slopes and in swales. The Hillfield soil is on the ridges and steep slopes that face south and west. This Welby soil and Hillfield soil have a profile similar to that described as typical for the Welby series and the Hillfield series. The Welby soil occurs where the growing season is 150 to 170 days.

Included with this complex in mapping are small areas of Hillfield and Welby soils that have slopes of 10 to 15 percent.

The soils in this complex are well drained and are moderately permeable. Runoff is medium.

These soils are used mainly for dryland wheat and alfalfa. Capability unit IIIe-U, nonirrigated.

Welby-Hillfield silt loams, 10 to 30 percent slopes (WhE).--These soils occur on lake terraces and lake terrace escarpments. About 60 percent of the complex is Welby silt loam, 10 to 20 percent slopes, and 40 percent is Hillfield silt loam, 20 to 30 percent slopes.

The Welby soil is on slopes that face north and east, and its profile is similar to the one described as typical for the Welby series. The surface layer is 7 to 10 inches thick. Runoff is medium, and the erosion hazard is high.

The Hillfield soil is mainly on ridges that face south and west. Its profile is similar to the one described as typical for the Hillfield series.

The soils in this complex are used mainly for range in spring and fall. Capability unit VIe-U, nonirrigated.

FORMATION AND CLASSIFICATION OF SOILS

This section describes the factors that affected the formation of the soils in Utah County: Central Part, and classifies the soils according to the current system of classification. The soil series in this survey area, including a profile representative of each series, are described in the section "Descriptions of the Soils."

Factors of Soil Formation

Soils differ from one another because of variations in the factors that govern their formation. These factors are topography or land form, climate, vegetation, parent material, and time. Regional differences in soils usually reflect differences in climate and vegetation, but local differences are more often caused by differences in topography, parent material, and time.

The soils in this survey area formed on pre-Lake Bonneville alluvial fans and glacial moraines that border the Wasatch Mountains. Some of the steep soils on hillsides have a distinct B horizon of clay. The topographic position of these landforms suggests very little alteration in their shape during the last glacial period. Presumably, the interval for horizon differentiation in soils in these areas has been longer than for the other soils in the survey area.

An A1 horizon, a moderately fine textured B2 or B2t horizon, and a strong Cca horizon, or a lime cemented hardpan have developed in areas where limestone is dominant. The climate, or the amount of heat and moisture that is received, has a marked influence on the kind of soil that forms. Heat and moisture strongly influence the amount and kind of vegetation, the rate that organic matter decomposes, the rate at which minerals weather, and the removal

or accumulation of material in the different soil horizons. The amount and kind of vegetation influences the thickness or darkness of the surface layer; the poorly drained soils in the lower, wetter areas have a thick, black surface layer that is high in organic-matter content. Soils that formed under a grassland type of vegetation on the uplands have a dark-colored surface layer that has moderate amounts of organic matter.

In this survey area the influences of Pleistocene Lake Bonneville are strongly expressed in the pattern and kinds of soils that formed. For example, all of the soils that formed on Lake Bonneville sediments are limited in time to the recession of the lake. In areas above Lake Bonneville, however, the soils are older and are more strongly developed. The soils that formed in the Lake Bonneville sediments that are very strongly calcareous have been only moderately leached of calcium carbonate, and most do not have a B horizon, but they have an A1 horizon and a strong Cca horizon.

The soils that developed in lake sediments that are only slightly calcareous have an A1 horizon and a B2t horizon. Such features reflect the primary influence of time and parent material.

The degree of horizonation may reflect the influence of one or more of the factors of parent material, topography, and time. Soils on the alluvial fans, flood plains, and colluvial slopes have received fresh sediments at irregular intervals since Lake Bonneville receded. The length of time for horizon differentiation to take place has been relatively short for most of these soils, and their profiles lack most of the horizons that are common to older soils. The soils on the flood plains of the Spanish Fork River, the American Fork Creek, Santaquin Creek, and Dry Creek, have been in place long enough for a distinct A1 horizon to develop, but not for other horizons.

Topography

Most of Utah County: Central Part, is at elevations between 4,500 to 5,100 feet, but elevations are as much as 7,100 feet in Pole Canyon and on Traverse Mountain. The present level of Utah Lake is about 4,486 feet. Most areas that are used for cultivated crops are between elevations of 4,520 and 5,000 feet.

The five major landforms in this survey area are the low lake terraces that surround Utah Lake; the post-Lake Bonneville flood plains of streams that enter Utah Lake; the broad, high lake terraces and deltas built by rivers entering Lake Bonneville during the Pleistocene period; fans consisting of alluvial material and areas of colluvial material that are adjacent to the mountains; and hillsides and pre-Lake Bonneville fans of Wasatch Mountain.

The soils on the low lake terraces, alluvial fans, and flood plains that are at elevations of less than 4,600 feet received additional water from higher areas, and in many places the soils have a high water table. The Sunset, Kirkham, McBeth, and Bramwell soils developed in these areas.

Strong horizons of lime have formed in places, mainly because of the high water table and the upward movement of ground water that is highly charged with calcium carbonate. More than one horizon has been enriched 10 to 20 percent in some places, and the A1 horizon commonly contains lime. Lime hardpans, such as in the Holdaway soils, have 50 to 70 percent lime. The soils are generally mottled throughout the profile and the wetter soils are gleyed in the substratum. Wetness and the high organic-matter content of the soils causes reduction and transfer of iron. A fluctuating water table causes air to oxidize the iron and produces yellowish-brown, brown, or yellowish-red mottles, generally in the upper horizons or throughout the profile of the McBeth and other rapidly permeable soils. If the air or oxygen is severely restricted by the water, the iron is reduced and the soil material is gray or olive gray. The greenish or bluish colors of some very wet soils commonly change to brown or gray when exposed to air. The reduction of iron is more common in the lower horizons, in the slowly permeable soils, and in soils, such as the Logan, that have a high, stagnant water table most of the time. The nearly level Logan, Chipman, Ironton, and Provo Bay soils on low lake terraces have developed under these conditions. These soils are poorly drained and very poorly drained; the Provo Bay soils, in the Provo Bay area, are flooded occasionally by Utah Lake.

Near the base of the intermediate terrace escarpments, especially in the vicinity of Vineyard, there are many seeps and springs where the organic Peteetneet soils formed. The Holdaway soils that have a lime hardpan occur in a roughly semicircular pattern around the Peteetneet soils. In the Holdaway soils the hardpan is thickest in areas near the springs, but it decreases in thickness with distance, and typically disappears within one-half mile of the springs. Apparently, this lime hardpan formed by the precipitation of lime from the underground water as it spread laterally from the springs.

The soils that formed on flood plains are usually nearly level, and most of them are moderately well drained to somewhat poorly drained. The dominant soils are the Kirkham, Sunset, and Benjamin, but the well-drained Pleasant Vale, Redola, and Steed soils also occur on flood plains.

On the flood plain of the Spanish Fork River, the medium-textured Sunset and Pleasant Vale soils are on the natural levees near the river channel, the moderately fine textured Kirkham soils are at a slightly greater distance from the river, and the fine-textured Benjamin soils occupy the outer edges.

The gravelly, coarse-textured Provo and Steed soils normally occupy areas near stream channels. The well-drained Steed soils are typically on the upper part of the flood plains, and the poorly drained Provo soils are on the lower part.

The water table of some soils is high enough for salts to be deposited on the surface as the upward moving water evaporates. If rainfall is insufficient to wash the salt out of the soil, it accumulates resulting in saline soils. Soils that contain significant amounts of salt and more than 15 percent exchangeable sodium are saline-alkali soils. These soils include those of the Arave, Jordan, and Payson series and some of the Benjamin, Chipman, and Kirkham soils. These soils are on the nearly level valley floor, where drainage is limited and artesian pressure contributes to the upward movement of the water.

The gravelly Bingham soils are typically near the mouth of canyons on the upper part of gently sloping to nearly level lake terraces. The medium-textured and moderately fine textured Timpanogos and Parleys soils are in the central part of terraces. The sandy Layton and Preston soils occur near the outer edges of the terraces as shore and terrace deposits. Locally, these terraces or deltas are known as the Orem, Mapleton, and Highland Benches. The low, rolling hills, which are slightly higher than the surrounding areas, are composed of sediments of the Alpine level (sometimes referred to as the Alpine Lake) of Lake Bonneville. These low hills occupy strips 1/4 to 1 mile wide and occur on the upper part of the terrace and to the north of the canyons. The strips are widest at the mouth of canyons, gradually narrowing to the north until they are buried by sediments of a later stage of Lake Bonneville.

During the dry period following the Alpine level (4), the streams cut fairly deep, wide channels through the deltaic material on these terraces. These deep channels carried water and sediments from melting snow into the lake, which apparently protected the low hills so they were not covered. The elevation of these terraces ranges from 4,820 to 5,050 feet. The McMurdie, Taylorsville, Welby, and Hillfield soils developed in these areas.

The terrace escarpments in this survey area are strongly sloping to very steep. Hillfield and Layton soils occupy the very steep escarpments, and the Sterling, Lakewin, and Hillfield soils are on the strongly sloping to steep escarpments. Typically, the gravelly Sterling and Lakewin soils are along the edges of the terraces. Because in these areas erosion removes the surface horizon almost as fast as it is formed, the soils have no or only a weakly developed B horizon.

The alluvial fans and the colluvial slopes adjacent to the mountains are sloping to steep, and they typically overlie lake sediments. In places, such as roadcuts and gravel pits, the recent deposits of alluvium and colluvium are lying unconformably on top of the lake sediments.

The Pleasant Grove, Cleverly, and Kilburn soils developed in alluvium or colluvium. These soils lack a B horizon or the B horizon is weak, but the Pleasant Grove soils have a horizon of lime. Fresh sediments are deposited on the surface of these soils at irregular intervals, and erosion is active in many places. Because of this, horizon development is weak. Gullies have formed in some areas, especially on the foothills of West Mountain.

The pre-Lake Bonneville alluvial fans are strongly sloping to steep. They are typically adjacent to the ancient Lake Bonneville shoreline. In places, such as the area south of Salem known as Goose Nest, they are overlain by lake sediments. The Manila and Dry Creek soils are dominant in these areas. They are among the ancient soils described by Hunt, Varnes, and Thomas (9).

Steep to very steep soils occupy the mountain slopes back of the fans. They are typically cobbly and stony and are eroded in places. The Henefer, Gappmayer, and Rake soils are common in these areas. Topography affects soil formation on these mountain slopes. On the south and west exposures, the microclimate is hotter and drier than that in level or gently sloping areas, and evaporation is greater because the soils are exposed to the sun during the warmest part of the day. On steep north-facing slopes, the microclimate is cooler and evaporation is less than on south- and west-facing slopes. In wet periods water percolates deeper into the soil causing leaching of the A horizon and clay and lime to accumulate at a greater depth.

The Gappmayer and McPhie soils developed in alluvium or colluvium from sandstone or other noncalcareous parent material. On north-facing slopes they have developed an A2 horizon and a B2t horizon. The Henefer and Manila soils on other slopes have not developed an A2 horizon.

The Picayune and Rake soils developed in alluvium or colluvium derived from limestone, but they have distinctly different profiles because they are on different exposures. The Rake soils are on south- and west-facing slopes, where the rate of evapotranspiration is highest. These soils have a calcrete hardpan at the depth to which water normally penetrates, typically somewhat less than 20 inches. The Picayune soils occur on north- or east-facing slopes. They lack a hardpan, and their A1 horizon is thicker and darker than that in the profile of the Rake soils.

Climate

The climate of Utah County: Central Part, ranges from dry subhumid to moist subhumid. The western part of the area is the driest, but rainfall increases toward the mountains in the eastern part of the survey area.

The climate is characterized by warm, dry summers, cold, moist winters, and fairly moist springs. The average annual precipitation is 16.7 inches at the lower power plant at American Fork and is 10 inches at the Utah Lake pumping station. Precipitation is about 24 inches in Pole Canyon at the southern end of the survey area. Most of the precipitation comes in winter and in spring. June, July, and August are the driest months.

The mean annual temperature is 49° or 50° F. at elevations below about 4,700 feet, but it is 51° or 52° F. between elevations of 4,700 and 5,200 feet. Air drainage from the canyons and the tendency for

cool air to settle in areas at lower elevations presumably accounts for this difference.

Climatic records show that the frost-free period is about 132 days at the Lake pumping station, which is at an elevation of 4,497 feet (2). The frost-free period is about 170 days at the lower power plant at American Fork, where the elevation is 5,063 feet. This station is at the mouth of American Fork Canyon where the air drainage is good. Lake terraces that are adjacent to the mouth of the canyon have a frost-free period of 150 to 170 days.

Although precipitation at the station at the lower American Fork power plant may be slightly higher, it is considered fairly representative of the area along the base of the mountains and on the lake terraces that are above 4,700 feet. The average precipitation is about 8 inches during the period November through March. During this period, when evapotranspiration is low, most of the precipitation that falls enters the soil and generally is sufficient to wet the moderately coarse textured, coarse-textured, and gravelly, medium-textured soils to field capacity. In the fine-textured, moderately fine textured, and medium-textured soils, water penetrates to a depth of only about 3 feet when precipitation is average and to a depth of 4 or 5 feet when it is more than average.

The gravelly, moderately coarse textured Cleverly and Kilburn soils and the medium-textured Dagor soils developed in alluvium derived from parent rock low in lime content. These soils are free of lime to a depth of about 30 inches. The medium-textured and moderately fine textured Bingham, Timpanogos, and Parleys soils developed in calcareous lake sediments, and lime has been leached from the A1 horizon and the upper part of the B2t horizon. These soils have a horizon of lime accumulation at a depth of about 20 inches, and a B2t horizon that formed by the downward movement of silicate clay. Thin, clay films are on the ped surfaces of these soils.

The Taylorsville and Welby soils formed in sediments that are very high in lime. Some leaching has occurred in these soils, but it has not removed all of the lime from the A1 horizon. The Cca horizon, at a depth of 13 to 24 inches, has the highest content of lime, but the lime content decreases below a depth of 40 or 50 inches, which indicates some translocation.

Vegetation

Perennial grasses apparently made up 65 to 80 percent of the original plant cover of this survey area. Oakbrush, big sagebrush, bitterbrush, snowberry, and other shrubs made up only about 10 to 20 percent of the cover. The soils that formed under this grassland type of vegetation have a dark-colored A1 horizon and about 2 to 3 percent organic-matter content. Soils of the Bingham, Kidman, Parleys, and Timpanogos series formed under this type of vegetation. Most of these soils are used for cultivated crops.

The vegetation on the low lake terraces, just above the present level of Utah Lake, consisted mainly of wiregrass and sedges. The poorly drained Chipman, Logan, and McBeth soils are on these terraces. These soils have a thick, black surface layer that is 3.5 to 13 percent organic matter. They also have a layer of peaty material in a few places. The Peteetneet soils also occur on the same terraces, generally in areas of springs and seeps. The Arave, Jordan, and Payson soils are on the terraces in areas affected by salt and alkali. The vegetation on these soils was a sparse growth of greasewood, saltgrass, and alkali sacaton; the organic-matter content averages 0.5 to 1.25 percent. Mixed alluvial land, saline, formed under only a sparse stand of greasewood, saltgrass, alkali sacaton, pickleweed, and samphire. Its profile has only a thin or no A1 horizon.

On the flood plains the original vegetation near the streams consists mainly of cottonwood, boxelder, and an understory of willow, wild rose, and bunchgrass, but the vegetation is mainly grasses and sagebrush in areas 1/4 to 1/2 mile from the streams. The well-drained Pleasant Vale soils in these areas have a dark-colored A1 horizon less than 20 inches thick. Their organic-matter content is 1.5 to 2 percent, and it decreases regularly with depth. The well-drained Dagor, Redola, and Keigley soils that occur in the drainageways or swales receive fresh sediments at irregular intervals. These soils are dark colored to a depth of 20 to 60 inches; the organic-matter content of the surface layer is 2 to 3 percent, and generally it does not decrease uniformly with depth. The organic-matter content is more than 1 percent throughout the profile.

The moderately well drained and somewhat poorly drained Sunset, Kirkham, and Benjamin soils are on flood plains and also have a dark-colored surface layer similar to that of the well-drained soils. Because plants on these soils obtain some water from the water table, the organic-matter content is 2 or 3 percent in the surface layer and is 0.6 to 1.4 percent below. The vegetation on these soils consists mainly of grass, but it also includes rubber rabbitbrush and big sagebrush. Saltgrass, greasewood, and alkali sacaton grow on the saline and alkali Benjamin and Kirkham soils.

At the northern and southern ends of the survey area the vegetation on the foothills and mountains consists mainly of grasses, big sagebrush, and oakbrush and a few conifers and aspen. The Henefer, Manila, and Dry Creek soils that formed in these areas have a dark-colored surface layer; the organic-matter content of the A1 horizon ranges from 3 to 5 percent. The Gappmayer and McPhie soils apparently developed under a mixed stand of conifers and aspens. They have a thin A1 horizon and a thick A2 horizon; the organic-matter content of the A1 horizon ranges from 5 to 10 percent.

Parent Material

The sediments that were deposited in ancient Lake Bonneville is a major source of parent material of the soils in this survey area. These sediments have mixed mineralogy and they differ in lime content.

The sediments that are high in lime are mainly from limestone and shale. The Bramwell, Chipman, Ironton, and Holdaway soils are typical of the soils that formed in these sediments. They occur on the low lake terraces, or lake plains, just above the present level of Utah Lake. The Alpine-level sediments on the high terraces are also high in lime; the McMurdie, Taylorsville, Welby, and Hillfield soils developed in these sediments. The alluvium on the flood plain of the Spanish Fork River, the American Fork River, and Santaquin Creek also derived mainly from limestone and shale and is high in lime. The Benjamin, Keigley, Kirkham, and Pleasant Vale soils are typical of the soils that formed in this alluvium.

The post-lake Bonneville colluvium or local alluvium at the base of the steep mountain slopes is typically gravelly, cobbly, or stony. This material is a few to several feet thick over lake sediments. Soils of the Pleasant Grove series are the principal soil that formed in calcareous colluvium. These soils are slightly or moderately calcareous in the A1 horizon. They have a Cca horizon below a depth of about 20 inches.

All of the soils that formed in calcareous sediments have a lime content of 20 to 40 percent. The ratio between the cation-exchange capacity and the percentage of clay is between 0.4 and 0.8. The amount of very coarse, coarse, and medium sand averages about 0.2 to 3.4 percent. These soils have a low content of the coarse sand.

The McMurdie, Taylorsville, Hillfield, and Welby soils that formed in the Alpine-level sediments are silty and have 50 to 70 percent silt in the control section. In contrast, the particle size distribution of the soils that developed in sediments low in lime have 25 to 50 percent silt and usually have 3.5 percent or more of very coarse, coarse, and medium sand in the control section.

The mineralogy appears to be uniform in the soils that formed in sediments low in lime. The ratio between the cation-exchange capacity and the percentage of clay is 0.8 to 1.2 and is consistently higher than in the soils that formed in sediments high in lime.

The sediments that are low in lime derived from a wider range of parent rocks, some of which contained no lime. These sediments were deposited extensively in the deltas that were formed by streams entering Lake Bonneville. These deltas and terraces are 200 to 300 feet higher than the low lake terraces.

The Highland Bench sediments derived mainly from granite, quartzite, and limestone. North of Dry Creek, the material is mainly from granite, quartz monzonite, and quartzite. The sediments in American Fork Canyon are more strongly influenced by limestone. The parent rocks for the Mapleton Bench sediments are mainly quartzite and sandstone, but there are some limestone and volcanic rocks (5). The Orem Bench is mainly material from quartzite and admixtures of limestone and sandstone. Soils on these benches include those of the Bingham, Kidman, Parleys, and Timpanogos series.

Material that was carried into the lake by streams was sorted by the lake waters. The coarser sediments were carried only a short distance before they were deposited near the mouth of canyons. These sediments are the parent material for the gravelly Bingham soils. The fine particles were carried farther out on the delta and are the parent material for the Parleys and Timpanogos soils. The Parleys soils formed in the moderately fine textured sediments, and the Timpanogos soils formed in the medium- textured sediments.

The sandy Layton and Preston soils are on the outer edges of terraces (pl. VII, bottom). Their parent material consists of material from sandy lake beaches or bars deposited in ancient Lake Bonneville. These laminated sediments have been extensively reworked by the wind (pl. VII, top). The Kidman soils, also extensively worked by the wind, are very fine sandy loams that are near the Preston and Layton soils.

The flood plain of Dry Creek, in an area south of Lehi, consists of alluvium derived mainly from granite, quartz monzonite, and quartzite and is low in lime. The Sunset and Martini soils that formed in this alluvium are 3 to 15 percent lime. Mica flakes are common.

The post-Lake Bonneville colluvium and local alluvium at the base of the steep mountain slopes derived mainly from quartzite and small amounts of limestone and are low in lime. The Cleverly and Kilburn soils that formed in this material generally have been leached of lime or the lime is in the substratum.

The Parleys and Timpanogos soils are typically noncalcareous in the A1 and B2t horizons, but in some areas they have been irrigated with water that carried calcareous sediments. The A1 horizon of these soils are 2 to 11 percent lime, and the B2t horizon is noncalcareous or is as much as 7 percent lime. The A1 horizon commonly has 2 to 5 percent more lime then the B2t horizon. Apparently the calcareous sediments that were deposited on the surface were mixed by cultivation and then were leached to the B2t horizon. Irrigation water that enters the soil through root channels or pores also deposits calcareous sediments in the subsurface horizons. Areas that are particularly affected are the southern and western parts of Mapleton Bench, areas that are south and east of Salem, and the bench south of Payson. These areas are served by the Strawberry Irrigation System. The water from this system frequently carries large quantities of calcareous sediments derived from shale and limestone. Samples of these sediments that were deposited in headgates and diversion structures contained 28 to 32 percent lime. Two main sources of these calcareous sediments are material that washed from shale on the nearly bare shale hills in Spanish Fork Canyon during summer thunderstorms and material from excessively eroded areas in the channel of Diamond Fork, which is in the Strawberry irrigation project.

The Henefer, Dry Creek, and Manila soils that formed on pre-Lake Bonneville fans and on hillsides

above the level of Lake Bonneville are usually gravelly or cobbly and have a B2t horizon of clay or silty clay. The coarse fragments in the Manila and Henefer soils are dominantly very fine grained sandstone. The influence of the parent material is reflected in the particle size distribution of the Manila soils. They have a silty plus clay to sand ratio of 3 to 1, and the sand fraction is 90 to 95 percent fine and very fine sand.

The Dry Creek soils resemble the Manila and Henefer soils, but they have a horizon of strong lime. The parent material of the Dry Creek soils is similar to that of the Manila and Henefer soils, but it is influenced more by limestone, schist, and plagioclase feldspar. In some places limestone cobblestones occur on the surface and throughout the profile. The ratio of the cation-exchange capacity and the percentage of clay ranges from 0.5 to 0.7 in the Henefer, Dry Creek, and Manila soils.

Sandstone is a source of parent material in the Gappmayer soils. These soils have an A2 horizon of cobbly loam and a B2t horizon of very cobbly loam.

The Picayune and Rake soils on hillsides above the level of Lake Bonneville have formed in material from limestone. The Rake soils have a moderately calcareous B2t horizon that is underlain by a strongly indurated calcrete hardpan at a depth of 12 to 20 inches that is about 50 percent gravel and cobblestones and 3 to 19 inches thick. The Rake soils are steep to very steep and are on slopes that face south and west. The average annual precipitation is 16 to 20 inches, and much of it falls late in winter and in spring. The snow melts rapidly and much of the moisture is lost by evaporation and runoff. Because of the rapid evapotranspiration rate and runoff, the amount of water that enters the soil is reduced, and it penetrates only to the depth of the hardpan. The water is used by plants and the calcium carbonate is deposited at this depth. The calcium carbonate probably was first deposited as coats on the coarse fragments, but eventually the coats joined to form calcrete.

The Picayune soils are at the higher elevations on north- and east-facing slopes. They do not have a hardpan; typically, the lime in the B2 horizon occurs as nodules and the soil mass is noncalcareous.

The Holdaway soils are strongly saline and alkali. They occur as small, isolated tracts south and west of the Pacific States Cast Iron Pipe Plant. They occupy small areas on the top of the nearly level, dissected outwash plain remnants that are 3 to 8 feet higher than the surrounding soils. These soils have a gypsum horizon that is 60 to 75 percent gypsum at a depth of 17 and 41 inches. The bottom of the gypsum horizon has an abrupt boundary where there is a distinct darkening of the soil and an increase in organic-matter content that indicates a buried A1 horizon. The gypsiferous sediments in which this soil formed were deposited as a continuum on the surface of a soil that is similar to the Holdaway soils. These sediments were deposited when Utah Lake was higher than at present and Provo Bay was partly covered by water.

Time

The kinds of horizons and the degree of profile development of soils depend in part on the length of time that the parent material has been in place. The amount of time varies from a few years to centuries.

The soils on flood plains, such as those of the Dagor, Redola, and Steed series, have the least degree of horizonation. They receive new sediments in periodic floods, and well-defined horizons have not had time to form. Some organic matter has accumulated in their surface layer to form an A1 horizon, but no further differentiation of horizons has occurred.

Lake Bonneville receded from the Provo Lake level to the present level of Utah Lake probably between 30,000 to 23,000 years ago. During this time, the soluble salts have been leached from the profile of the well-drained soils on the high and the intermediate terraces. In addition, the soils that had only moderately or slightly calcareous parent material have had the lime removed from their A1 and B2t horizons into the B3ca and Cca horizons. After the removal of the lime, some of the clay sized particles also have been removed from the A1 horizon to form the B2t horizon and occur as thin films on ped surfaces. This is typical of the Bingham, Timpanogos, and Parleys soils. The strongly or very strongly calcareous soils that developed in the Alpine Lake sediments, such as the Welby and Taylorsville soils, have not had sufficient time for all the lime to be removed but an A1 horizon and a strong Cca horizon have formed. The A1 horizon of the Taylorsville soils now is 5 to 10 percent lime, and the C horizon below the Cca horizon is about 20 percent lime. Thus, the A1 horizon appears to have lost 50 to 75 percent of its lime content.

The soils in the survey area that have been subjected to horizon differentiation for the longest time are those that formed on the pre-Lake Bonneville alluvial fans and on the steep hillsides above the level of that lake. These soils are much older than the soils that formed in Lake Bonneville sediments. The Henefer and Manila soils are strongly weathered, have a solum 50 inches or more thick, and have a distinct B2t horizon of clay. The topographic position of these landforms suggest very little alteration in their shape during the last glacial period.

The soils that formed in material weathered from limestone and shale, such as the Picayune and Rake, developed more slowly than the Henefer and Manila soils. They have been exposed to weathering the same length of time as the Henefer and Manila soils. They have A1, B2, B2t, and Cca horizons, but their solum is only 13 to 29 inches thick. Their A1 horizon is noncalcareous or only slightly calcareous, and their B2 and B2t horizons are typically slightly calcareous or moderately calcareous.

The Jordan and Payson soils developed in clayey, lake sediments deposited as aprons in front of the deltas. Although these soils developed in sediments presumed to be exposed to weathering much more

recently than the soils on the terraces, they have a developed A2 horizon that has platy structure and a B2t horizon that has strong prismatic structure. Because these sediments were affected by alkali, the formation of horizons has been rapid. These soils probably were formed in the period between the Alpine and Bonneville Lakes. Eardley and Gvosdetsky (6) observed a solodized soil at the edge of the Great Salt Lake that they assumed developed during this period.

The Jordan and Payson soils also could have formed in Alpine-level sediments during the interval between the Alpine and Bonneville levels. Their position in front of the deltas suggests that insignificant amounts of lake sediments were deposited on them after the Alpine level.

The Jordan and Payson soils have a 0.4 to 0.6 cation-exchange clay ratio and a silt and clay to sand ratio of slightly more than 8 to 1. The McMurdie soils of the high lake terraces developed in Alpine sediments and have a 0.6 cation-exchange clay ratio and a 12 or 15 to 1 silt and clay to sand ratio. The similarity of the ratios of these soils indicates similar parent material. These soils are all strongly developed, and they have a B2t horizon of clay or silty clay that has prismatic structure. The characteristics indicate that the Jordan, McMurdie, and Payson soils had similar stages of development and are similar in age. It appears that these soils could have developed in Alpine-level sediments during the period of aridity between the Alpine and Bonneville levels as suggested by Eardley and Gvosdetsky (5). The McMurdie soils, however, developed under well-drained conditions and are now nonsaline and nonalkali. They too were not covered by sediments of a later stage of Lake Bonneville. The Jordan and Payson soils, at lower elevations, formed under somewhat poorly drained or moderately well drained conditions and are saline and alkali.

The relationship between soils and their position on the landscape, as influenced by parent materials, is shown in figure 2.

The Logan, Chipman, and Holdaway soils, on the low lake terraces near Utah Lake, developed in calcareous lake sediments. The Layton, Preston, and Bramwell soils occupy the lower part of the Provo-level escarpments, and the Lakewin soils occupy the upper part. The Layton and Preston soils developed in windworked, sandy material from remnants of lake beaches. The Bramwell soils developed in nearly level, calcareous lake sediments.

The Kidman, Timpanogos, and Parleys soils occupy the western part of the Orem Bench. The gravelly Bingham soils occupy nearly all the area that extends from U.S. Highway No. 91 east to the edge of

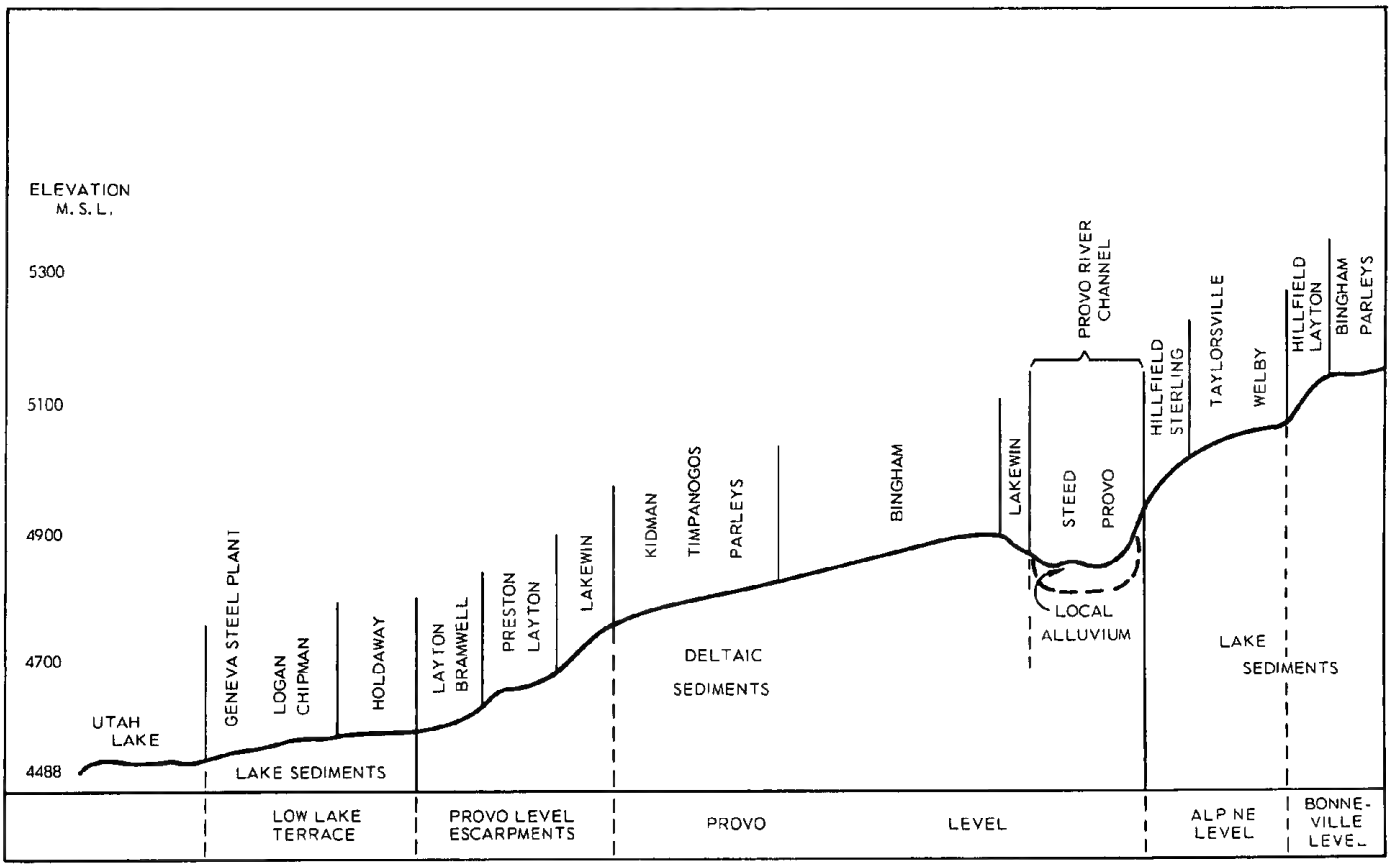


Figure 2.--Schematic drawing showing the relationship between soils and their position on the landscape, as influenced by parent material.

the bench. These soils developed in deltaic sediments deposited by the Provo River in ancient Lake Bonneville. The Bingham soils are on the upper part of the delta where the coarse fragments were deposited. The Parleys and Timpanogos soils developed in medium-textured and moderately fine textured sediments farther out on the delta. The Kidman soils developed in fine or very fine sandy loam near the outer edge of the delta.

The Steed and Provo soils are dominant on bottom land along the Provo River. These soils developed in calcareous alluvium deposited by the Provo River. The Hillfield, Taylorsville, and Welby soils occur on the bench east of the Provo River. They developed in calcareous sediments of the Alpine level. The Hillfield and Layton soils occupy the steep terrace escarpments that rise on the eastern edge of this bench. The Hillfield soils developed in calcareous, medium-textured, lake sediments. The Layton soils, on the Provo-level escarpments, developed in sandy, windworked deposits of lake beaches.

Classification of Soils

Soils are classified so that their significant characteristics can be more easily remembered. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through the use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (3) and revised later (11). The system currently used by the National Cooperative Soil Survey was developed in the early sixties (10) and was adopted in 1965 (14). It is under continual study.

Table 6 shows the classification of each soil series of Utah County: Central Part, by family, subgroup, and order, according to the current system. It also shows one category--the great soil group--of the 1938 system.

The current system of classification has six categories, beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Except for the soil series, the classes that make up the current system are defined briefly in the following paragraphs. Soil series is defined in the section "How This Survey Was Made." A detailed description of each soil series in this survey area is given in the section "Descriptions of the Soils."

ORDER: Ten soil orders are recognized in the current system of classification. They are Alfisols, Aridisols, Entisols, Histosols, Inceptisols, Mollisols, Oxisols, Spodosols, Ultisols, and Vertisols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions are Entisols and Histosols, which occur in many climates. Six of the soil orders that are represented in Utah County: Central Part, are Alfisols, Aridisols, Entisols, Histosols, Inceptisols, and Mollisols.

Alfisols have a B2t horizon, argillic or natric horizons, lack a thick, dark-colored A1 horizon, and have a base saturation of more than 35 percent.

Aridisols are usually dry and have a light-colored or thin surface layer, or are less than 1 percent organic matter in the surface 7 inches. They have a strong lime horizon within 40 inches of the surface or a salt horizon that is more than 2 percent soluble salts within 30 inches of the surface.

Entisols are mineral soils that have little, if any, horizon development.

Histosols are organic soils that formed in peat or muck.

Inceptisols are relatively young mineral soils in which horizons have definitely started to develop but do not have an accumulation of illuvial clay.

Mollisols have a thick, dark-colored surface layer that is 1 percent or more organic matter and a base saturation of 50 percent or more.

SUBORDER: Each order is divided into suborders, primarily on the basis of soil characteristics that produce classes having the greatest genetic similarity. A suborder has a narrower climatic range than an order. The criteria for suborders reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP: Each suborder is divided into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons. The horizons used to make separations are those in which clay, iron, or humus have accumulated, or those that have pans that interfere with the growth of roots or the movement of water and a thick, dark-colored surface horizon. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors that are associated with basic rocks, and the like. The great group is not shown separately in table 6, because it is the last word in the name of the subgroup.

SUBGROUP: Each great group is divided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have properties of one great group and also

TABLE 6.--CLASSIFICATION OF SOILS

Series	Current classification			1938 classification with later revisions
	Family	Subgroup	Order	Great soil group
Arave	Fine-loamy, mixed, mesic-	Aquic Natrustalfs	Alfisols	Solonetz.
Benjamin	Fine, montmorillonitic, mesic.	Aquic Fluventic Haplustolls.	Mollisols	Alluvial soils.
Bingham	Fine-loamy over sandy or sandy-skeletal, mixed, mesic.	Calcic Argixerolls	Mollisols	Chestnut soils.
Bramwell	Fine-silty, mixed, mesic-	Aquic Calciorthids	Aridisols	Solonchaks (calcium carbonate).
Chipman	Fine-silty, mixed, mesic-	Typic Calciaquolls	Mollisols	Solonchaks (calcium carbonate).
Cleverly	Coarse-loamy, mixed, mesic.	Typic Haploxerolls	Mollisols	Chestnut soils.
Dagor	Fine-loamy, mixed, mesic-	Cumulic Haploxerolls	Mollisols	Alluvial soils.
Dry Creek	Fine, montmorillonitic, mesic.	Abruptic Palexerolls	Mollisols	Chestnut soils.
Gappmayer	Loamy-skeletal, mixed, frigid.	Boralfic Argixerolls	Mollisols	Gray Wooded soils intergrading toward Brunizems.
Henefer	Fine, montmorillonitic, frigid.	Pachic Argixerolls	Mollisols	Brunizems.
Hillfield	Coarse-silty, mixed, mesic.	Calcixerollic Xerochrepts.	Inceptisols	Calcisols.
Holdaway	Fine-silty, mixed, mesic-	Petrocalcic Calciaquolls.	Mollisols	Solonchaks (calcium carbonate).
Ironton	Coarse-loamy, mixed, mesic.	Typic Calciaquolls	Mollisols	Solonchaks (calcium carbonate).
Jordan	Fine, mixed, mesic	Salorthidic Natrustalfs.	Alfisols	Solonetz.
Keigley	Fine-silty, mixed, mesic-	Cumulic Haploxerolls	Mollisols	Alluvial soils.
Kidman	Coarse-loamy, mixed, mesic.	Calcic Haploxerolls	Mollisols	Chestnut soils.
Kilburn	Loamy-skeletal, mixed, mesic.	Typic Haploxerolls	Mollisols	Chestnut soils.
Kirkham	Fine-silty, mixed, mesic-	Aquic Fluventic Haplustolls.	Mollisols	Alluvial soils.
Lakewin	Loamy-skeletal, mixed, mesic.	Calcic Haploxerolls	Mollisols	Chestnut soils.
Layton	Sandy, mixed, mesic	Calcic Entic Haploxerolls.	Mollisols	Regosols.
Logan	Fine-silty, mixed, mesic-	Typic Calciaquolls	Mollisols	Humic Gley soils.
Manila	Fine, montmorillonitic,	Typic Argixerolls	Mollisols	Brunizems.
Martini	Coarse-loamy, mixed, mesic.	Fluventic Haploxerolls-	Mollisols	Alluvial soils.
McBeth	Coarse-silty, mixed, calcareous, mesic.	Typic Haplaquolls	Mollisols	Humic Gley soils.
McMurdie	Fine, montmorillonitic, mesic.	Calcic Pachic Argixerolls.	Mollisols	Chestnut soils.
McPhie	Coarse-loamy, mixed, frigid.	Boralfic Argixerolls	Mollisols	Gray Wood intergrading toward Brunizems.
Parleys	Fine-silty, mixed, mesic-	Calcic Argixerolls	Mollisols	Chestnut soils.
Payson	Fine, mixed, mesic	Typic Natrustalfs	Alfisols	Solonetz.
Peteetneet	Loamy-skeletal, mixed, mesic.		Histosols	Bog soils.

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TABLE 6.--CLASSIFICATION OF SOILS

Series	Current classification			1938 classification with later revisions
	Family	Subgroup	Order	Great soil group
Picayune	Fine-loamy, mixed, frigid.	Calcic Haploxerolls	Mollisols	Chestnut soils.
Pleasant Grove	Loamy-skeletal, mixed, mesic.	Cumulic Calcixerolls	Mollisols	Calcisols.
Pleasant Vale	Coarse-loamy, mixed, mesic.	Entic Haploxerolls	Mollisols	Alluvial soils.
Pleasant View	Coarse-loamy, mixed, mesic.	Cumulic Haploxerolls	Mollisols	Alluvial soils.
Preston	Mixed, mesic	Typic Xeropsamments	Entisols	Regosols.
Provo	Sandy-skeletal, mixed, mesic.	Typic Haplaquolls	Mollisols	Alluvial soils.
Provo Bay	Fine-silty, carbonatic, mesic.	Typic Calciaquolls	Mollisols	Solonchaks (calcium carbonate).
Rake	Loamy-skeletal, mixed, mesic, shallow.	Petrocalcic Calcixerolls.	Mollisols	Chestnut soils.
Redola	Coarse-loamy, mixed, mesic.	Cumulic Haploxerolls	Mollisols	Alluvial soils.
Steed	Fragmental, mixed, mesic.	Entic Haploxerolls	Mollisols	Alluvial soils.
Sterling	Loamy-skeletal, mixed, mesic.	Typic Calcixerolls	Mollisols	Calcisols.
Sunset	Coarse-loamy, mixed, mesic.	Aquic Fluventic Haplustolls.	Mollisols	Alluvial soils.
Taylorsville	Fine-silty, mixed, mesic.	Calcixerollic Xerochrepts.	Inceptisols	Chestnut soils.
Timpanogos	Fine-loamy, mixed, mesic.	Calcic Argixerolls	Mollisols	Chestnut soils.
Vineyard	Coarse-loamy, mixed, mesic.	Aquic Calciustolls	Mollisols	Solonchaks (calcium carbonate).
Welby	Coarse-silty, mixed, mesic.	Typic Calcixerolls	Mollisols	Calcisols.

one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order.

FAMILY: Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name.

Laboratory Data[4/]

The results of laboratory analyses of samples, taken from selected soils, are shown by horizons in table 7. The analyses were made by the Soil Conservation Service and Utah State University Cooperative Soils Laboratory, Logan, Utah.

Methods of Analyses

All samples were air dried in the laboratory. They were then sieved by hand, using sieves 8 inches in diameter, through round openings 2 millimeters in diameter. Samples that appeared to have no appreciable amount of pebbles or stones, that is less than 5 percent, were poured through a mechanical crusher that has openings about 4 millimeters in diameter. Samples that contained an appreciable amount of pebbles or stones were broken up in an iron mortar without crushing the pebbles or stones. Where it was necessary to reduce the size of the sample, a Riffle sampler was used. Each laboratory sample was mixed thoroughly to insure uniformity, and all subsequent analyses were made on the fraction that was less than 2 millimeters in diameter. The percentage of material greater than 2 millimeters in diameter was calculated by dividing the weight of the fraction retained on the 2-millimeter sieve by the initial weight of the air-dry sample. Subsamples less than 2 millimeters in diameter were ground small enough to pass a sieve of 0.3 millimeter by use of a mortar and pestle. These subsamples were used to determine the organic carbon and calcium carbonate equivalent.

The official pipette method of analysis was used to determine particle-size distribution. Organic matter was destroyed by using hydrogen peroxide; except where specifically stated in the survey, lime was not removed. Sodium hexametaphosphate was used as a dispersing agent. The same fractions were determined by mechanical sieving through a series of sieves 2 inches in diameter. The pipette method of analysis was used on material less than 2 millimeters in diameter. The amount of material larger than 2 millimeters is expressed on the basis of the total weight of the air-dry sample; the amount of sand, silt, and clay is expressed on the basis of the oven-dry material.

Organic carbon was determined by the wet oxidation method using chromic acid (13). Silver sulfate was added to the sulfuric acid to prevent oxidation of chlorides where soluble salts were 0.1 percent or more. After oxidation and dilution, an excess of ferrous ammonium sulfate was added to the sample, and the material was then titrated with standard potassium permanganate. The permanganate also acted as an indicator, and a special titration light was used to help determine the exact endpoint. The organic-matter content was obtained by multiplying the percentage of carbon by 1.7.

To determine the calcium carbonate equivalent, the technician allowed variable weights of the sample to react in constant glass containers with 2N hydrochloric acid. The percentage of calcium carbonate equivalent was determined by referring manometer readings to a curve prepared from standard samples of calcium carbonate.

The reaction, or pH, was measured with a line-operated pH meter using a glass electrode with a calomel reference electrode. To determine the pH of soil-water suspensions in a ratio of 1 to 5, the suspensions were stirred vigorously immediately before the electrodes were inserted. At the first indication of stabilization, the pH was read; then, the process was repeated until duplicate readings were obtained. Distilled water, or water free of carbon dioxide, was used for all soil-water suspensions.

To determine the content of soluble salts, a standard Bureau of Soils cup was used to obtain the ohms of resistance of the soil paste at saturation moisture content. The percentage of total soluble salts was then obtained from standard tables after correcting for soil texture and temperature.

The exchangeable sodium percentage value was obtained by this computation:

$$ESP = \frac{ES}{CEC \times 100}$$

All percentage values and milliequivalents per 100 grams were obtained on the basis of the oven-dry soil.

A pipette cell with platinized platinum electrodes that had a cell constant of 0.5 was used with a resistance bridge to measure the electrical conductivity of the saturation extract. The pipette cell was equipped with a tapping key switch to avoid excessive flow of electric current. All values are expressed at 25° C.

To find the cation exchange capacity, samples of material less than 2 millimeters were saturated with sodium by four consecutive washings and centrifugations by using an IN-sodium-acetate solution with a pH adjusted to 8.2. Soluble sodium acetate was removed by washing with 95 percent ethanol. The exchangeable sodium was then removed by three consecutive washings with neutral normal ammonium acetate. The sodium was then measured on the flame photometer.

4/ JAMES P. THORNE, soil scientist, head of Cooperative Soil Laboratory, Logan, Utah, made the chemical and mechanical analyses.

TABLE 7.--PHYSICAL AND CHEMICAL

[Analyzed by the Soil Conservation Service and the Utah State University Cooperative Soils Laboratory,

Soil and horizon	Depth	Particle-size distribution					
		Very coarse sand (2-1 mm.)	Coarse sand (1-0.5 mm.)	Medium sand (0.5-0.25 mm.)	Fine sand (0.25-0.10 mm.)	Very fine sand (0.10-0.05 mm.)	Silt (0.05-0.002 mm.)
	In.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Bingham gravelly loam:							
Ap	0-6	4.2	7.8	10.9	13.2	12.9	35.9
B21t	6-12	3.9	7.7	11.8	14.6	11.7	28.0
B22t	12-18	7.7	9.1	12.2	17.5	12.4	22.8
IIB3tca	18-27	10.2	9.9	14.0	21.6	12.8	19.2
IIC1ca	27-40	30.4	28.2	22.5	10.7	1.7	3.7
Bramwell silty clay loam:							
Ap	0-6	.1	.7	1.0	2.8	9.6	61.8
A1	6-11	.2	.7	1.0	2.4	9.7	61.1
C1	11-20	----	----	----	----	----	----
C2ca	20-31	.2	.3	.3	1.6	4.5	54.8
C3ca	31-60	.3	.5	.2	.7	10.8	64.7
Chipman silty clay loam:							
Apca	0-8	0	.3	.4	1.8	3.5	64.4
A1g	8-15	.5	.6	.9	5.2	5.5	58.3
C1cag	15-20	.6	1.1	1.9	10.5	15.3	44.3
C2ca	20-27	.2	.7	1.5	10.0	13.2	46.3
C3ca	27-44	.2	.8	2.2	15.1	21.4	45.5
C4cag	44-60	.1	.4	1.9	8.3	12.7	44.0
Cleverly gravelly fine sandy loam:							
Ap	0-7	9.2	7.5	4.4	9.2	15.0	47.3
A1	7-16	10.6	10.5	5.6	10.4	14.3	35.7
B21t	16-29	10.4	8.1	4.2	8.8	14.7	43.7
B3	29-42	9.9	9.3	5.0	9.9	14.4	34.9
Cca	42-56	11.3	8.2	4.4	10.3	19.6	35.7
Dagor loam:							
Ap	0-6	6.2	6.4	3.7	6.9	13.3	44.5
C1	6-24	4.9	7.6	4.1	8.8	15.3	41.7
C2	24-36	7.6	5.5	3.5	10.1	16.7	37.8
C3	36-60	3.6	5.6	3.2	7.2	13.2	45.9
Dry Creek cobbly loam:							
A1	0-5	2.2	3.3	2.2	6.5	18.0	46.4
A3	5-9	1.7	3.0	2.1	5.1	16.1	46.0
B21t	9-15	.9	1.8	1.3	2.7	9.6	32.2
B22t	15-26	1.2	1.9	1.7	3.5	6.3	25.2
B3ca	26-29	8.3	10.0	6.0	8.2	8.0	25.3
C1ca	29-48	4.4	10.8	6.8	9.8	8.8	27.9

See footnote at end of table.

ANALYSES OF SELECTED SOILS

Logan, Utah. Lack of data indicates analyses were not made]

Particle-size distribution--Continued		Reaction (saturated paste)	Organic matter	Soluble salt (Bureau cup)	Electrical conductivity	Calcium carbonate equivalent	Cation exchange capacity	Exchangeable sodium
Clay (<0.002 mm.)	Coarse fragments (>2 mm.)							
Pct.	Pct.	pH	Pct.	Pct.	Mmhos./cm. at 25° C.	Pct.	Meq./100 gm. of soil	Pct.
15.1	20	7.3	1.87	0.03	1.01	----	13.4	----
22.3	25	7.0	.86	.04	.90	----	16.4	----
18.3	40	7.1	.79	.03	.33	----	13.9	----
12.3	60	7.5	.71	.03	.87	----	10.7	----
2.8	85	8.2	.26	<.03	.38	11.0	3.53	----
24.0	----	8.0	2.60	.56	14.6	4.3	20.0	24
24.9	----	8.3	1.87	.21	5.2	3.9	20.0	9
----	----	8.2	.86	.15	4.0	14.0	19.1	----
38.3	----	8.5	.69	.26	5.49	46.2	11.5	19
22.8	----	8.0	.33	.10	2.17	30.1	7.2	12
29.6	----	7.8	5.30	.06	1.27	34.9	25.0	2
29.4	----	7.8	2.79	.09	1.17	5.7	28.6	2
26.3	----	7.9	1.58	.10	1.93	32.2	19.3	3
28.1	----	7.8	.83	.10	2.45	44.0	12.7	3
14.8	----	7.9	----	.08	1.38	40.9	9.5	4
32.6	----	7.7	----	.07	.86	31.3	18.1	2
7.4	23	6.9	2.58	.04	1.1	----	16.2	1
12.9	31	6.8	1.00	.03	.8	----	16.2	1
10.1	20	6.9	.91	.07	1.8	----	16.4	0
16.6	23	7.2	----	.08	2.0	----	16.0	0
10.6	47	7.3	----	.08	2.3	----	12.2	0
19.0	----	7.5	3.27	----	1.67	----	18.9	4
17.6	----	7.3	2.00	----	.54	----	18.5	5
18.8	----	7.9	1.24	----	.38	----	19.2	4
21.3	----	6.9	1.17	----	.35	----	19.7	4
21.4	20	6.0	2.86	.03	1.00	----	16.7	----
26.0	20	6.0	1.98	.03	.63	----	17.8	----
50.5	31	5.8	1.20	.06	.42	----	33.4	----
60.2	30	6.2	1.25	.07	.42	----	35.5	----
34.2	5	7.8	1.07	.04	.42	43.9	19.7	----
31.5	5	7.5	.91	.03	.54	49.0	17.2	----

TABLE 7.--PHYSICAL AND CHEMICAL

Soil and horizon	Depth	Particle-size distribution					
		Very coarse sand (2-1 mm.)	Coarse sand (1-0.5 mm.)	Medium sand (0.5-0.25 mm.)	Fine sand (0.25-0.10 mm.)	Very fine sand (0.10-0.05 mm.)	Silt (0.05-0.002 mm.)
	In.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Dry Creek extremely stony loam, stony subsoil variant:							
A1	0-4	1.8	4.4	3.1	5.7	17.0	51.3
B1	4-10	2.3	4.1	2.6	4.6	12.4	45.4
B21t	10-14	2.5	4.2	2.8	4.2	10.5	41.8
B22t	14-20	4.4	7.0	4.5	7.3	8.8	33.1
B3	20-30	10.4	14.5	8.6	12.4	9.8	22.0
C1ca	30-43	15.9	20.2	11.2	14.9	9.9	17.3
C2	43-60	10.3	20.2	11.9	14.5	10.5	20.2
Gappmayer cobbly loam:							
A11	0-6	.7	1.4	1.3	6.4	30.2	46.6
A12	6-10	.5	1.0	1.2	6.4	32.0	45.5
A21	10-19	.6	1.3	1.5	7.2	32.4	42.9
A22	19-30	.9	1.7	1.5	6.7	30.8	40.5
A&B	30-44	----	----	----	----	----	----
B2t	44-56	.7	1.5	1.2	5.9	30.5	40.4
B3	56-63	.4	1.0	1.5	7.9	34.2	39.5
Henefer loam:							
A11	0-3	----	----	----	----	----	----
A12	3-7	----	----	----	----	----	----
B11	7-15	----	----	----	----	----	----
B21t	15-25	----	----	----	----	----	----
B22t	25-33	----	----	----	----	----	----
B23t	33-43	----	----	----	----	----	----
B3	43-58	----	----	----	----	----	----
C1	58-65	----	----	----	----	----	----
Hillfield silt loam:							
Ap	0-4	0	.5	.8	4.7	27.2	54.4
AC	4-12	.1	.3	.5	4.2	27.3	54.5
C1ca	12-26	0	.2	.4	2.6	28.2	51.5
C2ca	26-35	0	.6	.8	4.9	45.3	36.9
C3ca	35-40	----	----	----	----	----	----
IIC4	40-46	----	----	----	----	----	----
Holdaway silty loam:							
Ap	0-7	----	----	----	----	----	----
A1	7-13	----	----	----	----	----	----
C1cag	13-20	----	----	----	----	----	----
C2camg	20-28	----	----	----	----	----	----
C3cag	28-32	----	----	----	----	----	----
C4cam	32-44	----	----	----	----	----	----
C5cam	44-55	----	----	----	----	----	----
C6camg	55-67	----	----	----	----	----	----

See footnote at end of table.

ANALYSES OF SELECTED SOILS--Continued

Particle-size distribution--Continued		Reaction (saturated paste)	Organic matter	Soluble salt (Bureau cup)	Electrical conductivity	Calcium carbonate equivalent	Cation exchange capacity	Exchangeable sodium
Clay (<0.002 mm.)	Coarse fragments (>2 mm.)							
Pct.	Pct.	pH	Pct.	Pct.	Mmhos./cm. at 25° C	Pct.	Meq./100 gm. of soil	Pct.
16.7	50	----	----	----	----	----	----	----
28.4	50	----	----	----	----	----	----	----
34.0	75	----	----	----	----	----	----	----
34.9	75	----	----	----	----	----	----	----
22.3	80	----	----	----	----	----	----	----
10.6	80	----	----	----	----	----	----	----
12.4	80	----	----	----	----	----	----	----
13.4	40	6.7	10.3	----	.43	----	29.1	----
13.4	40	6.5	6.24	----	.99	----	22.4	----
14.7	60	6.3	1.60	----	.80	----	9.0	----
17.9	50	6.4	1.24	----	.38	----	12.0	----
----	50	----	----	----	----	----	-----	----
19.8	55	6.5	1.12	----	.56	----	14.0	----
15.5	80	7.1	1.14	----	.58	----	13.3	----
----	----	7.2	3.90	----	----	----	----	----
----	----	6.7	2.44	----	----	----	----	----
----	----	6.6	1.26	----	----	----	----	----
----	----	6.2	1.03	----	----	----	----	----
----	----	6.3	----	----	.54	----	34.8	----
----	----	6.3	----	----	.47	----	28.9	----
----	----	5.9	----	----	.48	----	35.7	----
----	----	6.2	----	----	.46	----	26.9	----
12.4	----	7.7	2.36	----	----	17.0	----	----
13.1	----	7.9	1.67	----	----	18.0	----	----
17.1	----	8.2	.57	----	----	33.0	----	----
11.5	----	8.6	.31	----	----	29.0	----	----
----	----	8.7	.24	----	----	46.0	----	----
----	----	8.9	.15	----	----	20.0	----	----
----	----	7.9	4.25	.09	----	22.0	30.0	6
----	----	7.7	4.58	.06	----	19.0	----	----
----	----	7.8	5.73	.06	----	36.0	----	----
----	----	7.7	----	----	(1/)	48.0	----	----
----	----	7.8	3.80	.04	----	63.0	----	----
----	----	8.1	----	----	(1/)	74.0	----	----
----	----	8.2	1.98	----	----	66.0	----	----
----	----	8.0	----	----	(1/)	72.0	----	----

Soil and horizon	Depth	Particle-size distribution					
		Very coarse sand (2-1 mm.)	Coarse sand (1-0.5 mm.)	Medium sand (0.5-0.25 mm.)	Fine sand (0.25-0.10 mm.)	Very fine sand (0.10-0.05 mm.)	Silt (0.05-0.002 mm.)
	In.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Holdaway silt loam, strongly saline-alkali:							
A11	0-4	----	----	----	----	----	----
A12cs	4-9	----	----	----	----	----	----
C1cssa	9-17	----	----	----	----	----	----
C2cs	17-34	----	----	----	----	----	----
C3cs	34-41	----	----	----	----	----	----
IIA1ca	41-53	----	----	----	----	----	----
IIC4cam	1/ 53-63	----	----	----	----	----	----
Ironton loam:							
Ap	0-8	.2	.6	1.8	13.9	29.5	35.1
C1cag	8-17	0	.5	1.8	14.4	28.9	34.7
C2cag	17-25	.1	.7	2.0	12.9	22.3	37.5
C3cag	25-32	.3	1.3	3.0	14.1	21.4	35.9
IIC4g	32-60	.3	1.2	3.1	19.7	37.7	29.2
Jordan silt loam:							
A1	0-1	0	.3	6.9	20.6	25.8	43.5
A2	1-7	0	.3	8.2	17.7	15.4	51.2
B2tsaca	7-15	0	.2	6.4	11.0	4.5	33.8
B3saca	15-23	0	.2	4.5	7.7	3.2	49.3
C1saca	23-40	0	.1	.6	1.3	1.8	57.6
C2ca	40-55	0	.1	.1	.2	1.4	59.4
C3	55-60	0	.1	.2	.7	6.4	65.0
Keigley silty clay loam:							
Ap	0-7	.1	.4	.8	4.4	9.1	58.7
A12	7-19	0	.1	.4	2.7	7.8	58.7
A13	19-27	0	.1	.2	2.0	8.4	58.6
C1	27-42	0	.1	.3	2.7	9.3	57.0
C2	42-65	.1	.3	.5	2.6	6.7	58.5
Kidman very fine sandy loam:							
Ap	0-8	.1	.4	1.8	19.8	37.8	28.8
B2	8-20	0	.2	1.2	16.7	40.5	29.8
C1	20-32	0	.2	1.2	17.9	41.2	29.9
C2	32-44	0	.2	1.3	18.1	42.2	29.0
C3ca	44-60	0	.2	1.3	13.2	34.1	40.1
Kirkham silty clay loam:							
Ap	0-11	0	.1	.1	1.6	13.9	57.2
C1	11-17	0	.1	.1	.7	9.4	64.0
C2	17-28	0	0	.1	.6	6.5	66.3
C3	28-42	0	.1	.1	.3	1.3	52.9
C4	42-50	0	.1	.1	.8	18.3	57.4
C5	50-65	.1	.6	.8	4.3	27.7	49.9

See footnote at end of table.

ANALYSES OF SELECTED SOILS--Continued

Particle-size distribution--Continued		Reaction (saturated paste)	Organic matter	Soluble salt (Bureau cup)	Electrical conductivity	Calcium carbonate equivalent	Cation exchange capacity	Exchangeable sodium
Clay (<0.002 mm.)	Coarse fragments (>2 mm.)							
Pct.	Pct.	pH	Pct.	Pct.	Mmhos./cm. at 25° C	Pct.	Meq./100 gm. of soil	Pct.
----	----	8.0	16.20	0.70	26.12	34.6	59.2	12
----	----	8.3	7.07	2.0	35.82	24.7	36.2	11
----	----	8.7	2.24	2.0	30.43	21.6	17.0	6
----	----	8.1	.74	.15	6.70	15.4	6.4	4
----	----	8.2	.74	.15	5.94	22.6	7.4	0
----	----	8.1	1.50	.30	6.61	33.4	16.5	3
----	----	8.3	.21	.15	6.00	19.0	----	----
18.9	----	7.7	3.90	.07	1.52	19.3	19.0	2
19.7	----	7.7	2.77	.06	1.11	23.0	17.6	2
24.5	----	7.7	2.91	.04	.65	36.2	16.8	1
24.0	----	7.6	2.24	.03	.59	36.9	14.1	2
8.8	----	7.7	.60	.03	.67	4.1	7.9	3
2.9	----	8.3	3.84	.15	3.65	4.2	7.9	25
7.2	----	8.6	.83	.06	1.83	1.0	9.8	27
44.1	----	9.9	.88	2.50	21.3	23.9	18.2	85
35.1	----	10.2	.33	2.50	28.4	19.5	15.6	91
38.6	----	10.2	.28	2.50	19.7	27.2	16.3	98
38.8	----	10.2	.26	1.20	12.8	21.9	16.1	95
27.6	----	9.8	.19	.55	7.53	17.8	16.0	78
26.5	----	7.8	2.63	.04	.58	28.5	19.7	1
30.3	----	7.9	1.77	.03	.44	30.9	19.6	1
30.7	----	8.0	1.08	.05	.63	29.7	19.7	1
30.6	----	7.9	.88	.08	1.02	32.3	18.4	1
31.3	----	8.0	.53	.06	.77	35.3	16.6	1
11.3	----	7.8	1.51	.03	.74	4.8	10.3	4
11.6	----	7.6	.58	.03	.51	0	9.3	4
9.6	----	7.6	.36	.03	.76	0	7.4	5
9.2	----	7.6	.29	<.03	.53	0	6.6	6
11.1	----	8.0	.34	.03	.76	15.6	5.9	5
27.1	----	8.1	2.12	.06	.91	27.9	18.0	2
25.7	----	8.3	1.43	.05	.86	32.3	17.0	4
26.5	----	8.3	1.15	.09	1.68	34.5	16.8	11
45.3	----	8.2	1.15	.20	3.06	27.9	24.8	14
23.3	----	8.2	.71	.20	3.83	29.5	14.7	15
16.5	----	8.1	.55	.10	2.00	25.2	12.0	7

TABLE 7.--PHYSICAL AND CHEMICAL

Soil and horizon	Depth	Particle-size distribution					
		Very coarse sand (2-1 mm.)	Coarse sand (1-0.5 mm.)	Medium sand (0.5-0.25 mm.)	Fine sand (0.25-0.10 mm.)	Very fine sand (0.10-0.05 mm.)	Silt (0.05-0.002 mm.)
	In.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Lakewin gravelly fine sandy loam:							
A11	0-3	2.1	8.8	16.3	19.5	12.3	30.8
A12	3-10	2.0	8.5	16.6	19.6	12.2	28.6
B21	10-19	1.7	7.7	17.0	22.9	12.5	24.9
B22	19-27	2.6	8.4	20.1	26.3	12.8	19.1
IIC1ca	27-37	5.0	12.6	30.3	34.7	8.2	5.8
IIC2ca	37-60	1.9	10.7	33.9	39.1	7.6	3.6
Layton fine sandy loam:							
A11	0-2	.2	2.9	13.5	36.5	21.8	13.9
A12	2-7	.2	2.2	11.9	35.5	21.6	18.2
AC	7-14	.1	1.5	9.4	34.5	26.1	19.7
C1	14-26	.1	1.4	13.2	38.2	24.6	15.5
C2ca	26-39	0	.6	4.5	45.0	26.5	15.7
C3ca	39-57	.1	3.0	18.4	59.5	11.5	4.8
Logan silty clay loam:							
O2	8-0	----	----	----	----	----	----
A11g	0-9	----	----	----	----	----	----
A12g&O	9-13	----	----	----	----	----	----
C1cag	13-17	----	----	----	----	----	----
C2cag	17-28	----	----	----	----	----	----
C3cag	28-36	----	----	----	----	----	----
C4cag	36-56	----	----	----	----	----	----
C5g	56-77	----	----	----	----	----	----
Logan silty clay loam, heavy variant:							
Ap	0-7	----	----	----	----	----	----
A12	7-16	----	----	----	----	----	----
ACca	16-23	----	----	----	----	----	----
C1ca	23-39	----	----	----	----	----	----
A1b	39-46	----	----	----	----	----	----
C2	46-60	----	----	----	----	----	----
Manila silt loam:							
A11	0-6	.1	.3	.5	3.1	21.7	54.6
B1	6-17	.1	.3	.4	2.3	18.9	50.1
B2t	17-42	.1	.2	.3	2.1	13.1	42.4
B3	42-63	.8	1.3	1.7	8.9	29.2	31.1
C	63-73	.6	1.0	1.4	8.2	27.2	39.4
Martini fine sandy loam:							
Ap	0-9	5.9	10.4	7.9	23.5	17.9	25.9
A1	9-12	3.4	6.4	5.3	21.8	24.3	31.1
C1	12-17	1.4	4.1	6.1	30.7	28.5	23.3
C2	17-32	3.4	7.0	13.4	41.2	15.2	13.8
C2	32-50	2.3	6.8	12.8	38.1	17.0	16.7
C3	50-60	4.6	15.2	20.5	21.8	11.1	18.7

See footnote at end of table.

ANALYSES OF SELECTED SOILS--Continued

Particle-size distribution--Continued		Reaction (saturated paste)	Organic matter	Soluble salt (Bureau cup)	Electrical conductivity	Calcium carbonate equivalent	Cation exchange capacity	Exchangeable sodium
Clay (<0.002 mm.)	Coarse fragments (>2 mm.)							
Pct.	Pct.	pH	Pct.	Pct.	Mmhos./cm. at 25° C	Pct.	Meq./100 gm. of soil	Pct.
10.2	28	7.3	2.51	.03	.99	----	14.8	1
12.5	25	7.4	1.46	.03	.58	----	13.9	1
13.3	37	7.3	.76	.03	.47	----	13.4	1
10.7	65	7.2	.62	<.03	.49	----	10.8	1
3.4	65	7.7	.43	<.03	.66	15.0	4.6	2
3.2	55	8.3	.28	<.03	.27	4.0	3.2	3
11.2	----	7.2	5.18	.03	.86	0	11.2	1
10.4	----	7.4	.80	.04	1.37	0	9.6	2
8.7	----	7.5	.55	.05	1.22	.4	8.5	2
7.0	----	7.6	.20	.03	.94	0	6.6	2
7.7	----	8.4	.15	.03	.97	10.6	4.6	7
2.7	----	8.3	.05	<.03	.77	5.2	3.3	6
----	----	6.9	43.4	.35	6.03	14.4	116.4	1
----	----	6.9	11.8	.15	3.43	1.5	51.1	1
----	----	7.0	26.3	.15	2.93	9.5	80.4	1
----	----	7.5	2.63	.15	2.26	37.6	18.5	1
----	----	7.5	1.77	.10	2.15	44.8	14.8	2
----	----	7.6	1.16	.15	2.19	49.8	12.6	2
----	----	7.5	.67	.10	2.47	40.8	8.3	2
----	----	7.3	2.18	.15	1.83	27.9	26.2	1
----	----	7.6	10.7	.35	5.32	6.6	51.4	8
----	----	7.5	4.02	.15	1.18	0	50.1	3
----	----	7.5	2.30	.10	.88	19.0	39.2	2
----	----	7.7	1.55	.06	.67	27.4	30.2	2
----	----	7.6	3.65	.08	.64	8.0	39.0	2
----	----	7.7	.96	.03	.73	70.8	7.97	3
19.7	7	7.0	4.75	.04	1.08	----	19.6	----
27.9	7	6.0	1.19	.04	.53	----	16.3	----
41.8	7	5.9	.60	.05	.25	----	25.7	----
27.0	30	6.3	.38	.04	.30	----	19.1	----
22.2	30	7.2	.28	.04	.30	----	17.6	----
8.5	----	7.5	1.74	.03	1.56	12.8	8.92	2
7.7	----	7.6	1.43	.03	.87	12.4	8.74	1
5.9	----	7.7	.53	.03	.76	10.9	77.03	0
5.9	----	7.7	.58	.03	.59	10.1	6.12	3
6.3	----	7.7	.48	.03	.79	12.0	6.19	3
8.1	----	7.6	.50	.03	.80	14.3	6.22	3

TABLE 7.--PHYSICAL AND CHEMICAL

Soil and horizon	Depth	Particle-size distribution					
		Very coarse sand (2.1 mm.)	Coarse sand (1-0.5 mm.)	Medium sand (0.5-0.25 mm.)	Fine sand (0.25-0.10 mm.)	Very fine sand (0.10-0.05 mm.)	Silt (0.05-0.002 mm.)
	In.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
McBeth silt loam:							
Ap	0-8	0.8	1.7	1.9	6.9	10.6	52.3
A1	8-12	.6	1.5	1.6	7.1	11.6	53.3
C1g	12-18	.1	1.7	4.9	6.6	9.4	54.9
C2g	18-24	.1	3.0	8.6	17.0	25.4	35.8
C3g	24-36	0	.2	.3	6.6	35.6	49.2
C3g	36-53	0	.2	.6	4.3	17.7	65.7
C4g	53-68	.1	.3	.8	4.5	10.5	67.8
McMurdie silt loam:							
Ap	0-7	.1	.2	.2	1.1	9.9	67.2
B1	7-11	0	.2	.1	.9	9.5	66.2
B2t	11-25	0	.1	.1	1.5	2.9	53.3
B3ca	25-35	0	.1	.1	.5	2.9	54.3
C1ca	35-47	.3	.5	.3	1.0	3.7	52.6
C2ca	47-63	0	.5	.6	1.1	2.6	62.0
McPhie sandy loam:							
A11	0-7	9.8	12.8	6.9	10.8	13.4	33.4
A12	7-12	10.0	10.8	6.1	10.2	14.3	36.8
A2	12-24	8.5	13.5	8.0	12.1	14.1	33.3
B&A	24-30	9.2	14.0	7.8	11.6	13.8	32.1
B21t	30-38	6.7	8.8	5.6	10.6	16.2	37.8
B22t	38-55	7.8	11.7	6.7	10.6	13.0	34.2
B3	55-60	12.6	18.8	9.3	13.2	9.4	21.7
Parleys loam:							
Ap	0-7	1.7	2.3	2.3	11.0	21.1	40.5
B2t	7-20	.5	.7	.8	4.7	13.1	46.6
B3ca	20-35	.1	.3	.3	2.3	9.6	55.3
G1ca	35-51	.3	.3	.5	4.2	17.8	51.2
C2	51-67	.9	.8	.7	3.8	14.4	55.3
Payson silty clay loam:							
A21	0-4	----	----	----	----	----	----
A22	4-9	----	----	----	----	----	----
B1	9-14	----	----	----	----	----	----
B2t	14-21	----	----	----	----	----	----
B3ca	21-29	----	----	----	----	----	----
C1ca	29-33	----	----	----	----	----	----
C2ca	33-48	----	----	----	----	----	----
C3	48-68	----	----	----	----	----	----
Picayune cobbly silt loam:							
A1	0-6	.8	1.5	1.1	2.5	11.3	53.5
B2	6-12	2.1	1.8	2.7	3.1	9.0	46.8
B31ca	12-23	2.6	1.6	2.6	2.8	9.5	46.5
B32ca	23-29	1.4	2.3	1.6	3.4	13.4	42.7
C1ca	29-40	.3	2.0	3.1	6.2	7.3	57.3
C2ca	40-53	.2	1.6	3.6	7.7	6.9	61.8

See footnote at end of table.

ANALYSES OF SELECTED SOILS--Continued

Particle-size distribution--Continued		Reaction (saturated paste)	Organic matter	Soluble salt (Bureau cup)	Electrical conductivity	Calcium carbonate equivalent	Cation exchange capacity	Extractable sodium
Clay (<0.002 mm.)	Coarse fragments (>2 mm.)							
Pct.	Pct.	pH	Pct.	Pct.	Mmhos./cm. at 25° C	Pct.	Meq./100 gm. of soil	Pct.
25.8	----	8.0	5.25	0.19	4.65	39.5	25.2	5
24.3	----	8.0	4.30	.13	3.01	38.4	20.1	5
22.4	----	7.9	3.77	.11	2.44	41.9	20.8	5
10.1	----	8.0	1.29	.04	1.65	31.5	15.3	6
8.0	----	7.6	1.63	.05	1.16	35.1	17.7	5
11.5	----	7.9	3.59	.05	1.25	27.4	14.7	6
16.0	----	7.8	2.03	.07	1.60	36.2	12.7	7
21.3	----	7.4	1.79	.07	1.47	----	15.0	5
23.1	----	7.0	1.65	.04	.66	----	16.7	
42.1	----	7.3	1.12	.08	.62	----	26.7	3
42.1	----	8.0	.81	.08	.57	4.1	26.9	4
41.4	----	8.1	.69	.08	.93	7.8	23.7	5
33.2	----	7.9	.29	.06	.74	17.9	16.0	9
12.9	15	6.1	7.64	.03	1.20	----	26.6	----
13.0	15	5.5	4.78	.03	.67	----	21.9	----
10.5	25	6.2	1.75	.03	.88	----	12.5	----
11.5	25	6.0	.74	.03	.52	----	11.9	----
14.3	25	6.0	.62	.03	.74	----	13.4	----
16.0	30	5.8	.48	.03	.48	----	13.8	----
15.0	40	5.9	.44	.04	1.01	----	13.9	----
21.1	----	7.2	2.87	.07	1.30	0	29.3	6
33.6	----	7.4	1.31	.09	.70	0	42.0	1
32.1	----	7.9	1.24	.08	.52	8.0	36.2	1
25.7	----	7.8	.74	----	.58	15.0	30.2	2
24.1	----	8.0	.72	.06	.58	7.0	19.4	2
----	----	7.9	2.96	.04	1.08	6.8	23.0	2
----	----	8.0	1.81	.05	.70	10.5	20.3	4
----	----	7.9	1.50	.05	.62	16.9	20.3	3
----	----	8.5	.96	.11	1.99	27.2	22.2	22
----	----	8.7	.79	.19	2.86	38.7	18.7	33
----	----	8.9	.57	.28	2.49	43.7	19.3	33
----	----	8.9	.45	.40	6.39	40.1	27.9	33
----	----	8.7	.40	.91	12.94	30.1	20.0	52
29.3	22	7.2	8.05	.03	1.12	0	31.8	0
34.5	45	7.4	2.86	.08	.76	11.0	24.7	1
34.5	50	7.4	2.10	.08	.64	19.7	22.7	1
35.2	35	7.6	1.79	.07	.62	25.4	24.2	1
23.8	35	7.6	2.36	.04	.59	63.4	16.8	1
18.2	----	7.7	1.96	.03	.51	71.2	13.0	1

TABLE 7.--PHYSICAL AND CHEMICAL

Soil and horizon	Depth	Particle-size distribution					
		Very coarse sand (2-1 mm.)	Coarse sand (1-0.5 mm.)	Medium sand (0.5-0.25 mm.)	Fine sand (0.25-0.10 mm.)	Very fine sand (0.10-0.05 mm.)	Silt (0.05-0.002 mm.)
	In.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Pleasant Grove stony loam:							
A11	0-2	7.3	8.5	5.5	8.0	11.8	45.1
A12	2-6	6.7	8.4	6.4	8.9	11.0	42.7
A13	6-21	7.1	9.4	6.9	8.8	10.3	41.1
C1ca	21-38	7.4	10.4	8.2	11.3	11.8	35.9
C2ca	38-49	10.2	11.4	9.2	13.0	11.5	33.1
C3ca	49-60	3.2	5.4	6.0	12.3	15.2	42.9
Pleasant Vale loam:							
Ap	0-6	.2	.8	2.8	18.8	27.2	34.8
A1	6-17	.3	.9	3.3	20.8	27.1	32.8
C1	17-24	.4	1.1	3.6	23.6	25.3	34.7
C2	24-40	.7	1.4	3.5	23.7	31.4	28.8
C3	40-48	.6	1.7	2.6	23.7	34.5	27.3
C4	48-60	----	----	----	----	----	----
Pleasant View fine sandy loam:							
Ap	0-6	3.7	8.5	9.1	22.7	18.7	25.4
C1	6-14	4.5	10.4	10.3	18.6	15.6	27.4
C2	14-23	4.8	11.6	12.0	21.2	15.7	22.6
IIC3ca	23-30	11.3	16.4	14.0	19.9	11.8	16.9
IIC4ca	30-60	27.6	22.1	10.6	12.0	6.9	13.3
Preston fine sand:							
A1	0-3	0	6.1	19.0	62.6	8.1	.3
A12	3-17	0	.5	19.3	64.6	8.7	2.9
C1	17-33	0	.6	17.9	63.4	10.3	3.4
A1b	33-45	0	.6	17.5	57.5	12.6	5.5
C2	45-60	0	.4	10.4	58.5	19.1	6.5
Provo gravelly fine sandy loam:							
Ap	0-7	1.8	2.7	5.4	22.0	20.3	35.7
A12g	7-15	2.8	3.6	6.7	21.3	18.9	33.5
C1g	15-25	43.1	25.9	11.8	7.0	1.9	4.7
IIC2	25-40	18.6	24.2	17.9	18.6	5.7	9.0
IIC3	40-50	37.8	27.6	12.3	8.3	3.1	5.7
Provo Bay silty clay loam:							
A11ca	0-3	.1	.6	.5	2.0	8.5	57.5
A12gca	3-8	.8	2.7	1.3	3.3	10.1	54.4
A13gca	8-13	.6	1.9	2.2	2.8	8.7	51.9
A14gca	13-22	.7	2.5	2.1	5.9	10.3	42.3
C1	22-33	1.9	7.0	3.6	7.3	22.0	45.6
C2	33-60	.1	.4	.3	.9	14.1	62.0

See footnote at end of table.

ANALYSES OF SELECTED SOILS--Continued

Particle-size distribution--Continued		Reaction (saturated paste)	Organic matter	Soluble salt (Bureau cup)	Electrical conductivity	Calcium carbonate equivalent	Cation exchange capacity	Extractable sodium
Clay (<0.002 mm.)	Coarse fragments (>2 mm.)							
Pct.	Pct.	pH	Pct.	Pct.	Mmhos./cm. at 25° C.	Pct.	Meq./100 gm. of soil	Pct.
13.8	40	7.4	7.60	0.05	1.72	5.1	25.2	1
15.9	40	7.7	4.16	.04	.93	5.1	22.9	1
16.4	40	7.6	1.84	.06	1.09	15.8	19.4	2
15.0	50	7.8	.95	.05	.83	20.6	13.4	3
11.6	50	7.8	.53	.03	.77	26.5	9.8	3
15.0	50	7.8	1.00	.07	1.56	20.0	15.3	33
15.4	----	7.6	1.81	.04	1.04	15.4	14.0	2
14.8	----	7.7	1.55	.04	1.11	15.1	13.6	2
11.3	----	8.1	.93	.05	1.91	20.0	9.8	7
10.5	----	8.1	.55	.10	3.85	22.3	8.1	17
9.6	----	8.5	.34	.15	2.88	22.0	7.3	19
----	----	8.5	.26	.15	2.39	19.7	5.9	18
11.9	----	7.6	2.90	----	1.08	.6	13.3	1
13.2	----	7.3	2.58	----	1.00	.1	14.1	1
12.1	----	7.1	1.70	----	.67	.3	12.1	1
9.7	45	7.4	1.74	----	.78	4.5	9.3	1
7.5	60	7.6	1.75	----	.72	11.5	6.8	2
3.9	----	7.9	.83	<.03	.94	----	4.5	7
4.0	----	8.0	.31	<.03	.49	----	3.8	6
4.4	----	8.1	.21	<.03	.49	----	3.5	8
6.3	----	8.0	----	<.03	.50	----	4.4	7
5.1	----	8.2	----	<.03	.33	----	3.7	10
12.1	20	7.7	2.98	.03	.64	8.7	18.9	1
13.2	20	7.6	2.87	.04	.74	8.9	18.1	1
5.6	60	7.7	.76	<.03	.86	9.4	5.8	1
6.0	80	8.0	.68	<.03	.61	7.9	5.1	2
5.2	70	8.0	.40	<.03	.86	8.7	4.3	9
30.8	----	7.2	9.30	.31	5.94	50.0	26.6	3
27.4	----	7.2	8.12	.14	3.37	56.0	23.9	2
31.9	----	7.3	10.70	.10	1.94	51.0	29.9	2
36.2	----	7.6	10.29	.09	1.40	47.4	33.9	2
12.6	----	7.9	1.03	.06	1.58	42.9	8.7	8
22.2	----	7.7	.76	.09	1.56	32.4	13.5	7

TABLE 7.--PHYSICAL AND CHEMICAL

Soil and horizon	Depth	Particle-size distribution					
		Very coarse sand (2-1 mm.)	Coarse sand (1-0.5 mm.)	Medium sand (0.5-0.25 mm.)	Fine sand (0.25-0.10 mm.)	Very fine sand (0.10-0.05 mm.)	Silt (0.05-0.002 mm.)
	In.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Rake extremely stony loam:							
A1	0-6	1.5	3.9	4.8	8.4	17.3	41.5
B2t	6-13	1.6	4.5	4.1	7.9	13.6	36.3
C1cam	1/13-32	----	----	----	----	----	----
C2ca	32-37	13.5	20.4	11.2	13.9	10.8	21.7
Redola loam:							
Ap	0-8	----	----	----	----	----	----
C1	8-20	4.2	7.2	5.7	11.7	14.4	35.2
C2	20-30	----	----	----	----	----	----
C3	30-50	----	----	----	----	----	----
IIC4	50-60	----	----	----	----	----	----
Steed gravelly sandy loam:							
A1	0-7	----	----	----	----	----	----
C1	7-31	----	----	----	----	----	----
C2	31-41	----	----	----	----	----	----
C3	41-60	----	----	----	----	----	----
Sterling gravelly fine sandy loam:							
Ap	0-5	5.3	11.1	12.4	15.2	14.0	28.0
A12	5-11	5.6	13.4	15.3	14.9	13.7	23.3
C1ca	11-16	7.3	15.7	23.3	13.9	8.8	19.7
C2	16-21	7.0	19.6	25.4	17.3	7.9	14.1
C3ca	21-60	19.5	12.4	21.4	29.1	6.1	6.8
Sunset loam:							
Ap	0-7	3.1	5.3	4.6	14.4	21.3	37.7
A	7-14	2.2	5.0	4.4	15.2	21.7	37.2
C1	14-28	2.0	7.3	6.6	21.9	27.9	25.9
C2	28-34	1.7	4.4	3.8	13.8	16.9	42.1
C3	34-41	2.1	6.0	5.1	20.5	22.7	34.0
C4	41-48	1.7	3.3	2.2	5.3	10.3	52.3
C5	48-60	7.0	8.6	4.3	8.9	14.4	42.6
Taylorsville silty clay loam:							
Ap	0-7	0	.2	.2	1.1	8.9	65.6
AC	7-13	0	.2	.1	1.0	9.2	64.0
C1	13-27	0	.1	.8	.5	4.3	63.0
C2	27-36	0	.1	.1	.4	3.6	63.7
C3ca	36-56	----	----	----	----	----	----
C4	56-62	0	.1	.1	.2	1.0	74.4

See footnote at end of table.

ANALYSES OF SELECTED SOILS--Continued

Particle-size distribution--Continued		Reaction (saturated paste)	Organic matter	Soluble salt (Bureau cup)	Electrical conductivity	Calcium carbonate equivalent	Cation exchange capacity	Extractable sodium
Clay (<0.002 mm.)	Coarse fragments (>2 mm.)							
Pct.	Pct.	pH	Pct.	Pct.	Mmhos./cm. at 25° C	Pct.	Meq./100 gm. of soil	Pct.
22.6	55	7.5	4.95	0.04	0.70	3.6	28.1	0
32.2	55	7.6	3.53	.05	.50	12.1	33.4	1
----	50	----	----	----	----	----	----	----
8.5	65	8.1	.76	.03	.48	71.8	6.0	4
----	----	7.9	2.20	----	----	20.0	12.7	----
21.6	----	7.8	1.96	----	----	13.0	12.7	----
----	----	7.9	1.31	----	----	8.0	10.5	----
----	----	7.8	2.03	----	----	3.0	15.2	----
----	48	8.0	.34	----	----	3.0	3.7	----
----	----	7.6	2.01	<.03	1.37	33.2	6.86	2
----	----	7.7	.72	<.03	.81	32.3	4.77	3
----	----	7.8	1.06	<.03	.53	34.9	6.34	2
----	----	8.0	.64	<.03	.45	39.3	4.24	3
14.0	20	8.1	2.70	.04	1.28	12.0	13.8	----
13.8	22	8.2	1.44	.03	.88	10.3	11.3	----
11.3	30	8.0	.89	<.03	.71	26.4	7.4	----
8.7	65	8.2	.76	<.03	.58	28.8	5.7	----
4.7	85	8.4	.41	<.03	.12	30.9	3.1	----
13.6	----	8.0	2.75	----	6.42	5.7	15.8	8
14.3	----	8.3	2.08	.10	3.53	5.7	15.7	9
8.4	----	8.2	.93	.04	1.22	3.5	10.8	10
17.3	----	8.0	1.32	.04	.94	2.7	18.1	6
9.6	----	8.1	.77	.03	.72	3.8	12.7	8
24.9	----	7.9	1.60	.09	.77	1.3	26.1	4
14.2	----	8.0	1.13	.04	.37	7.0	16.0	6
24.0	----	7.9	2.56	.04	2.26	7.1	21.8	3
26.5	----	8.1	2.06	.04	.78	6.0	22.5	4
31.3	----	8.1	1.00	.05	.50	22.2	15.8	4
32.1	----	8.2	.72	----	.96	26.6	13.9	7
----	----	8.7	.48	.10	1.90	36.4	10.7	14
24.2	----	8.4	.16	----	7.37	31.2	18.0	12

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Soil and horizon	Depth	Particle-size distribution					
		Very coarse sand (2-1 mm.)	Coarse sand (1-0.5 mm.)	Medium sand (0.5-0.25 mm.)	Fine sand (0.25-0.10 mm.)	Very fine sand (0.10-0.05 mm.)	Silt (0.05-0.002 mm.)
	In.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Timpanogos loam:							
Ap	0-9	1.0	3.9	3.7	13.7	22.2	40.1
B2t	9-14	1.7	2.9	2.6	11.4	19.2	39.9
B3ca	14-18	.9	2.6	2.5	10.8	19.5	45.2
C1ca	18-30	.1	.5	.7	4.4	9.1	73.0
C2ca	30-48	.1	.5	1.0	4.1	14.2	69.6
IIC3	48-60	11.8	20.7	11.8	18.4	15.2	17.7
Vineyard fine sandy loam:							
Ap	0-7	.1	.5	4.3	38.0	25.4	20.2
AC	7-13	0	.4	3.5	34.6	25.9	21.9
C1ca	13-24	.1	.3	3.0	33.2	26.9	20.6
C2ca	24-35	.1	.3	2.0	31.7	28.7	21.5
C3ca	35-42	0	.4	1.6	32.2	34.4	18.2
C4	42-60	0	.2	1.0	27.0	43.5	19.4
Welby silt loam:							
Ap	0-7	.2	.7	.7	9.1	24.9	50.5
A1	7-12	.3	.7	.7	10.7	25.9	48.3
AC	12-22	0	.2	.3	7.4	26.5	51.6
C1ca	22-40	0	.3	.2	2.6	13.4	71.1
C2ca	40-54	0	.2	.1	.6	6.6	83.7
C3	54-65	0	.2	.1	.7	4.0	84.7

1/ Hardpan.

ANALYSES OF SELECTED SOILS--Continued

Particle-size distribution--Continued		Reaction (saturated paste)	Organic matter	Soluble salt (Bureau cup)	Electrical conductivity	Calcium carbonate equivalent	Cation exchange capacity	Extractable sodium
Clay (<0.002 mm.)	Coarse fragments (>2 mm.)							
Pct.	Pct.	pH	Pct.	Pct.	Mmhos./cm. at 25° C.	Pct.	Meq./100 gm. of soil	Pct.
15.4	----	7.3	3.61	0.03	1.71	1.4	15.2	1
22.3	----	7.5	.86	.04	.80	.5	13.8	2
18.5	----	7.7	.56	.03	.82	5.4	10.4	2
13.3	----	8.0	.43	.04	.42	9.9	6.8	3
10.5	----	8.0	.24	.03	.49	13.2	7.2	2
5.1	----	8.0	.10	.03	.56	19.4	3.4	4
11.5	----	7.4	1.38	.07	2.17	2.3	12.7	2
13.7	----	7.8	.80	.05	1.41	5.4	12.2	3
15.9	----	8.0	.53	.05	1.76	22.8	9.4	5
15.7	----	8.4	.35	.04	1.55	35.5	6.9	2
13.2	----	7.9	.36	.04	1.27	28.2	6.9	4
8.9	----	8.0	.20	.03	1.08	23.6	6.9	5
13.9	----	8.1	1.92	.05	1.22	10.8	14.6	6
13.4	----	8.1	1.51	.05	1.08	12.8	13.2	7
14.0	----	8.2	.77	.05	1.04	23.3	10.7	8
12.4	----	7.7	.36	.04	.92	37.0	7.2	12
8.8	----	8.0	.22	.04	.98	34.3	7.9	11
10.3	----	8.0	.17	.07	1.53	31.9	9.9	10

This section describes the early settlement; physiography, relief, and drainage; and the climate of Utah County: Central Part.

Early Settlement

The first white men in Utah Valley probably were Francisco Antanasio Dominguez and Silvestre Velezde Escalante. They entered the valley through the Spanish Fort Canyon on September 23, 1776. William H. Ashley of the Rocky Mountain Fur Company may have been the next white man in the valley. The Rocky Mountain Fur Company sent Entienne Provost and several other men to explore and to trap mink and beaver in the area of the Rocky Mountains. John C. Fremont passed through the valley in 1843.

Brigham Young, president of the Mormon Church, sent an exploration party into southern Utah County in 1847. In 1849, John S. Higbee, who had been in the first exploration party, and 30 families, about 150 people, built Fort Utah along the Provo River, about 2 1/2 miles west of the center of the present city of Provo. The fort wall was 14 feet high and the log houses were on the inside. Small settlements, or towns, were soon established about 6 miles apart for a distance of about 50 miles. These settlements were Mountainville (Alpine), Lehi city, American Fork, Battle Creek (Pleasant Grove), Provo City, Springville, Palmyra city (Spanish Fork), Payson, and Summitville (Santaquin). The people lived within the town limits and farmed areas outside the towns.

The Union Pacific Railroad was completed on November 18, 1873, and the Denver and Rio Grande Western Railway in 1889.

The first newspaper The Provo Daily Times was published in the territory south of Salt Lake in 1872.

The total population of Utah County was 2,005 in 1851, 57,382 in 1940, and 106,991 in 1960. Most of the growth in population between 1940 and 1960 was in the urban areas, especially in Provo and Orem; many of the rural areas decreased in population during this same period.

Physiography, Relief, and Drainage

This survey area is within the Great Basin section of the Basin and Range Physiographic Province (7) and is part of Utah Valley.

The area consists of some pre-Lake Bonneville fans and mountainous areas, and of lake terraces and deltas deposited by rivers entering Pleistocene Lake Bonneville (8) and by recent alluvial fans, colluvial slopes, and flood plains deposited on the lake sediments.

The major part of the survey area is at elevations of 4,500 to 5,100 feet. The present level of Utah Lake is about 4,486 feet. Elevations are as much as 7,100 feet in Pole Canyon and the Traverse Mountain Range. The Wasatch Mountains are along the eastern edge of the survey area; Mount Timpanogos, which is due east of Pleasant Grove, is the highest mountain in this range. It is at an elevation of as much as 11,000 feet. These high, barren, rocky mountains intercept storms as they travel eastward, and they store the heavy snow that is so important to the agricultural and industrial economy of the area.

The west face of the Wasatch Mountain is commonly cited as a fault scarp. The fault line parallels the base of the mountain, extending in a north-south direction. Fans consisting of recent alluvium are along this fault line in some places, particularly about 1 mile north of the mouth of Spanish Fork Canyon.

Nearly all of the water supplying facilities (pipelines, canals, and aqueducts) that serve the cities and farming areas in Utah Valley cross this fault line. Any movement along this fault line would disrupt these facilities and probably would cause considerable damage to housing developments or other buildings.

The sediments from the American Fork, Provo, and Spanish Fork Rivers provided most of the material for the extensive lake terraces. This material was deposited during the ancient Lake Bonneville period. These rivers also deposited most of the sediments on the more recent alluvial fans and flood plains. The American Fork Creek drains the northeastern part of the survey area, the Provo River the central part, and the Spanish Fork River the southern part. All of these rivers drain into Utah Lake, and they have cut deep channels through the lake terraces. The Jordan River, which flows north into the Great Salt Lake, is the outlet for Utah Lake.

This survey area can be divided into five general physiographic areas: Low lake terraces; flood plains; high lake terraces; foothills; and hillsides of Wasatch Mountain.

The nearly level low lake terraces are in the lower part of the valley and they surround Utah Lake. The flood plains are smooth and nearly level to gently sloping. They lie below the high lake terraces and have been deposited on the low lake terraces by streams entering the area. The flood plain of the Spanish Fork River is the largest in the area. Under natural conditions, the soils on the low lake terraces and much of the flood plains have a high water table and many of them contain excessive salts and alkali.

The high lake terraces are made up of material deposited as deltas by streams entering ancient Lake Bonneville. These terraces are 200 to 300 feet higher than the low lake terraces. The foothills consist of alluvium and colluvium from the mountains above. They are strongly sloping to steep and are dissected by drainageways in many places.

The hillsides of mountains are steep and very steep, and bedrock crops out in many places. They are generally covered with oakbrush and grass and are used mainly for grazing.

Dry Creek, Hobble Creek, and Santaquin Creek are minor streams that drain into Utah Lake. Dry Creek and Santaquin Creek have formed alluvial fans that are of minor importance in the area. Hobble Creek drains into Provo Bay within a short distance after leaving the canyon. The Spanish Fork River also drained into this bay at one time.

Provo Bay is an area, south and west of Provo, that covers approximately 6,970 acres in the southeastern part of Utah Lake. It is about one-third open water 5 inches to 3 feet deep. The remaining acreage is flooded occasionally, but generally the soils have a high water table, and they support a dense growth of cattails and other water-loving plants.

Climate

Utah County: Central Part lies at the foot of the western part of the Wasatch Mountain. The principal land area slopes gradually upward from the shores of Utah Lake. The lake averages 4,488 feet above sea level, but a large acreage of good farmland lies along the bench areas about 100 to 200 feet higher than the lake.

This survey area has a continental climate; relatively low humidity; abundant sunshine, except in winter and early in spring; relatively light precipitation; and a wide variation in temperature during the year. Data on temperature and precipitation for the survey area are given in table 8 and

TABLE 8.--TEMPERATURE AND PRECIPITATION DATA

Provo (Elevation 4,470 feet)

Month	Temperature				Precipitation			
			Two years in 10 will have--			One year in 10 will have--		
	Average daily maximum	Average daily minimum	Maximum temperature equal to or higher than--	Minimum temperature equal to or lower than--	Average total	Less than--	More than--	Average snow fall
	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Inches
January	37.2	14.2	60	-13	1.40	0.45	2.85	11.9
February	44.1	20.1	64	- 8	1.32	.37	2.72	5.9
March	53.1	26.9	75	7	1.29	.60	2.80	5.3
April	64.3	34.1	85	19	1.30	.33	2.84	(1/)
May	73.4	40.4	91	26	1.17	.30	2.84	(1/)
June	82.6	46.6	99	31	.79	.03	1.86	0
July	92.1	53.8	101	39	.68	.10	1.60	0
August	89.7	52.1	100	38	.96	.09	1.95	0
September	81.4	42.8	95	27	.66	.03	1.96	0
October	68.7	34.4	86	19	1.35	.04	2.79	(1/)
November	51.6	24.7	74	6	1.25	.18	2.18	3.1
December	40.6	18.8	60	- 9	1.33	.52	2.65	8.0
Year	64.9	34.1	----------	----------	13.50	------	------	34.2
Santaquin (Elevation 5,220 feet)								
January	39.0	16.5	52	1	1.75	(1/)	3.25	16.9
February	43.5	20.0	57	4	1.87	.76	3.61	13.6
March	51.6	26.5	66	13	2.26	.97	3.96	12.6
April	62.6	35.1	77	23	2.08	.54	4.20	4.2
May	69.6	42.7	85	32	1.78	.30	3.46	.7
June	78.9	50.6	93	39	1.09	(1/)	2.55	(1/)
July	90.3	59.7	96	52	.79	.05	1.73	(1/)
August	88.5	58.4	96	49	1.05	.09	2.62	(1/)
September	80.2	49.3	91	37	.78	.02	2.08	(1/)
October	66.8	37.9	81	27	1.78	.02	3.09	1.4
November	50.5	25.6	64	11	1.73	.42	3.09	7.3
December	42.0	20.1	53	3	1.71	.57	2.71	13.4
Year	63.6	36.9	----------	----------	18.67	------	------	70.1

1/ Trace.

are from records kept at Provo and at Santaquin.

East of this survey area is the Wasatch Mountain where the highest elevation is more than 11,000 feet. Most of the water for the survey area comes from the abundant snowfall in this mountain. Precipitation ranges from slightly more than 10 inches in the vicinity of Utah Lake and Lehi at the northern end of the survey area to about 19 inches at Santaquin at the southern end of the survey area, but it averages 30 to 50 inches at higher elevations; this amount generally is adequate for the valley, except in the very driest years. About 60 percent of the annual precipitation falls in winter and spring, the wettest part of the year. March is the wettest month, but heavy rains also occur during August. Precipitation in winter and spring is associated with storms that occur over the Pacific Ocean from October through May and move from the west coast through Utah. In summer precipitation is associated with thunderstorms that develop as masses of moist air move northward from the Gulf of Mexico.

A few periods of drought have occurred in the survey area. At this time even the heavy precipitation in the mountains was insufficient to maintain an adequate water supply. In 1933, one of the driest years, the Utah Lake-Lehi area recorded only 5.94 inches of precipitation. In 1926, the driest year of record at Santaquin, only 11.13 inches was measured. The driest year of record at Spanish Fork occurred in 1939 when 10.82 inches was recorded.

Snowfall in this survey area varies from place to place and from year to year. The annual snowfall ranges from about 34 inches a year at Provo to 70 inches at Santaquin. At Spanish Fork the heaviest snowfall was 148 inches, which occurred in 1922; at Santaquin, 138 inches of snow were recorded in 1955; the heaviest snowfall at Utah Lake-Lehi was 60 inches, which occurred in 1964.

The nearby mountains also influence the temperature of the survey area. As in most mountainous areas, there is a tendency for cold air to pool at the bottom of valleys and to form a strong inversion during the colder part of the year. The intensity of this inversion is illustrated by the differences in the growing season between stations near the level of the lake and those on the higher benches. The growing season is only 126 days at Provo, which is near the lake. The average frost-free period is 132 days at Utah Lake-Lehi at the northern end of the lake, and is 167 days at Spanish Fork.

The probability, in percent, and probable dates that specified temperatures will occur at the Utah Lake-Lehi station and at Provo in spring and in fall is shown in figure 3.

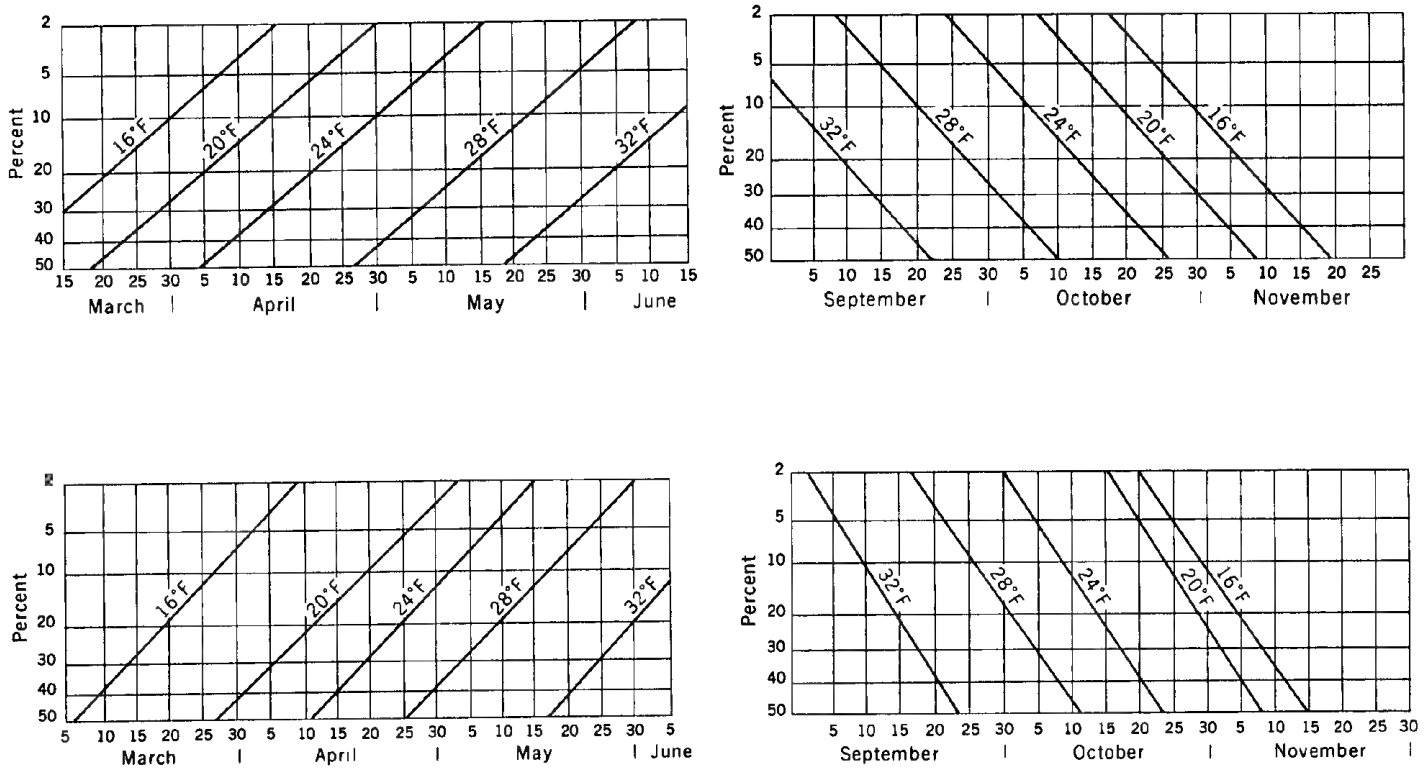

Figure 3.--Probabilities, in percent, and probable dates of last freezing temperatures in spring and first in fall for two places in the survey area. Upper pair of charts is for the airport at Provo and the lower pair is for the Utah Lake-Lehi station.

Summer temperatures are quite comfortable even though the average maximum temperature in July is about 92° F. the average minimum is about 53° F. Humidity generally is low.

In January the average maximum temperature is about 37° F. and the average minimum temperature is about 14° F. The cloud deck that usually forms during the cold part of the year near the top of the inversion helps to prevent extremely low minimum temperatures and it reduce the maximum temperatures.

In this survey area wind velocity is extremely variable, depending primarily on the particular location. Normal winds along the slopes are determined by the topography. Essentially, they are upslope during the warm part of the 24-hour period, and they are downslope during the cool part. These winds, however, are overridden during storms when strong winds from the south may blow for 24 to 36 hours before a storm. Following a storm the winds shift to the north and occasionally blow at a rate of more than 90 miles per hour. Extremely strong winds occur occasionally during the middle of the summer with local thunderstorms.

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Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvial fans. Alluvium deposited in fan- or cone-shaped deposits at the base of mountains.

Alluvial plains. A series of alluvial fans that have coalesced.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Coarse fragments. The gravel, cobblestones, or stones in a soil that range in size from 2 millimeters to 3 feet in diameter.

Cobblestones. Rounded mineral or rock fragments that range from 3 to 10 inches in diameter.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are--

Loose.--Noncoherent when dry or moist; does not hold together in a mass.

Friable.--When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.--When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.--When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.--When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.--When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.--When dry, breaks into powder or individual grains under very slight pressure.

Cemented.--Hard and brittle; little affected by moistening.

Deltaic. In this soil survey, refers to sediments deposited by streams as they entered ancient Lake Bonneville.

Depth, soil. In this soil survey, the terms and their meanings used to describe depth of the soil over bedrock or over a restricting layer are: Deep, more than 36 inches; moderately deep, 20 to 30 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Drainage, natural. The relative rapidity and extent of the removal of water from on and within the soil under natural conditions. Terms commonly used to describe drainage are--

Excessively drained.--Water is removed from the soil rapidly. The soils are typically sandy and porous.

Well drained.--Water is removed from the soil readily but not rapidly. There is no evidence of wetness above a depth of 40 inches.

Moderately well drained.--Water is removed from the soil somewhat slowly so that the soil is wet for short, but significant, periods of time.

Somewhat poorly drained.--Water is removed from the soil slowly enough to keep it wet for significant periods but not all the time. Wetness is apparent between a depth of 20 and 40 inches.

Poorly drained.--Water is removed from the soil so slowly that the water table is near the surface most of the time. Wetness is apparent within 20 inches of the surface.

Very poorly drained.--Water is removed from the soil so slowly that the water table is at or on the surface most of the time. These soils are generally in low areas or depressions.

Escarpment. In this survey area escarpments are steep slopes below lake terraces.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gravelly soil. A soil in which 20 to 50 percent of material by volume, consists of coarse fragments between 1/4 inch and 3 inches in diameter. A very gravelly soil is one in which 50 to 90 percent of material by volume is coarse fragments the size of gravel.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.--The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.--The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.--The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused by (1) accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.--The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.--Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are--

Border.--Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.--Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.--Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.--Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.--Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.--Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.--Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.--Irrigation water, released at high points, flows onto the field without controlled distribution.

Lake terrace. In this survey, a lake terrace is a prominence or bench that is higher than the surrounding area that was created as deltas by streams entering ancient Lake Bonneville. Where no streams are involved, wave action on the sea cliffs have also formed true lake terraces. Lake terraces are very inextensive in this survey area.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Low lake terrace. In this survey, low lake terraces, or lake plains, are typically just above the present level of Utah Lake. These areas were the bottom of ancient Lake Bonneville; they received mainly fine textured and moderately fine textured sediments.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance--few, common, and many; size--fine, medium, and coarse; and contrast--faint, distinct, and prominent. The size measurements are these: fine, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; medium, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and coarse, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables--hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Nutrients, plant. The elements that may be taken in by a plant, essential to its growth, and used by it in the production of food and tissue. These include nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, molybdenum, and perhaps other elements obtained from the

soil and oxygen, hydrogen, and carbon obtained mainly from air and water.

Parent material. The disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability, soil. That quality of the soil that enables it to transmit water or air. Terms used to describe permeability in inches per hour are: Very slow, less than 0.05 inch; slow, 0.5 to 0.2 inch; moderately slow, 0.2 to 0.8 inch; moderate, 0.8 to 2.5 inches; moderate rapid, 2.5 to 5.0 inches; rapid, 5.0 to 10.0 inches; and very rapid, more than 10 inches.

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range. Land that primarily produces native forage plants that are suitable for grazing domestic livestock.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Reclamation, soil. In this survey area, the removal of excess water, salts, and alkali from the soil profile so that the soil is made suitable for crops.

Relief. The elevations or inequalities of a land surface, considered collectively.

Roots (abundance of). Following are terms used to describe the number of roots that penetrate the soil: Abundant or many, more than 25 percent of surface area is penetrated; common, 3 to 25 percent of surface area is penetrated; few, less than 3 percent of surface area is penetrated.

Runoff. The rate that water flows from the land surface. Relative terms used to describe runoff are very rapid, rapid, medium, slow, very slow, and ponded.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Slightly saline.--The conductivity of the saturation extract of the soil is 4 to 8 millimhos within 30 inches of the surface.

Moderately saline.--The conductivity of the saturation extract of the soil is 8 to 16 millimhos within 30 inches of the surface.

Strongly saline.--The conductivity of the saturation extract is more than 16 millimhos within 30 inches of the surface.

Very strongly saline.--The soil contains more than 2 percent total soluble salt.

Saline-alkali soil. A soil that contains a harmful amount of soluble salts and so high a degree of alkalinity or so high a percentage of exchangeable sodium, or both, that the growth of most crop plants is significantly reduced. Terms used to describe the degree of contamination by salts and sodium are--

Moderately saline-alkali.--Conductivity of the saturation extract of the soils is 8 to 16 millimhos, and more than 35 percent of the specified area consists of soils that have a percentage of exchangeable sodium of 15 to 30 percent within 30 inches of the surface.

Strongly saline-alkali.--The conductivity of the saturation extract of the soils is more than 16 millimhos within 30 inches of the surface, and more than 35 percent of the specified area consists of soils that have a percentage of exchangeable sodium of more than 30 percent within 30 inches of the surface.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in

mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stones. Coarse fragments that range from 10 to 24 inches in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are--platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are (1) single grain (each grain by itself, as in dune sand) or (2) massive (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topography. See Relief.

Variant, soil. A soil that has properties sufficiently different from those other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

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GUIDE TO MAPPING UNITS

[For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. For complete information about a capability unit, read both the introduction to "Crops and Pasture" and the discussion of the capability unit in this section. For information about wildlife suitability groups, see the section beginning on page 24. Other information is given in tables as follows: Estimated yields of principal crops, pasture, and fruit trees, table 1, page 26. Use of the soils in engineering, table 2, page 34; table 3, page 44; and table 4, page 60. Acreage and extent, table 5, page 64]

HIGH INTENSITY

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page
Bd	Benjamin silty clay	69	IIIw-25	13	---	--
Be	Benjamin silty clay, moderately alkali	69	-------	--	VIIw-285	21
Bf	Benjamin silty clay, strongly alkali	70	-------	--	VIIw-285	21
Bg	Benjamin silty clay, sandy substratum	70	IIIw-25	13	---	--
BhB	Bingham loam, 1 to 3 percent slopes	71	IIIs-14	14	---	--
BkB	Bingham gravelly loam, 1 to 3 percent slopes	71	IVs-14	16	---	--
BmC	Bingham cobbly loam, 3 to 6 percent slopes	71	IVs-14	16	IVe-UX	15
BmD	Bingham cobbly loam, 6 to 10 percent slopes	71	IVs-14	16	IVe-UX	15
Br	Bramwell silty clay loam	72	IIIw-27	14	---	--
Bs	Bramwell silty clay loam, drained	72	IIIw-25	13	---	--
Ch	Chipman loam	73	IIw-2	11	---	--
Ck	Chipman silty clay loam	73	IIw-2	11	---	--
Cm	Chipman silty clay loam, moderately deep water table	74	IVw-25	16	---	--
Cn	Chipman silty clay loam, moderately saline	74	IIIw-27	14	---	--
Co	Chipman silty clay loam, strongly saline	74	-------	--	VIIw-285	21
Cp	Chipman-McBeth complex	74	IVw-25	16	---	--
CrD	Cleverly cobbly sandy loam, 6 to 15 percent slopes	75	IVs-14	16	IVe-UX	15
CsB	Cleverly gravelly fine sandy loam, 1 to 3 percent slopes	75	IIIs-14	14	IVe-UX	15
CsC	Cleverly gravelly fine sandy loam, 3 to 6 percent slopes	75	IIIs-14	14	IVe-UX	15
CsD	Cleverly gravelly fine sandy loam, 6 to 15 percent slopes	75	IIIe-14	12	IVe-UX	15
Da	Dagor loam	76	I-1	9	IIIe-U	13
Db	Dagor silt loam	76	I-1	9	IIIe-U	13
HmE	Hillfield silt loam, 10 to 20 percent slopes	82	-------	--	VIe-U	18
HmF	Hillfield silt loam, 20 to 30 percent slopes	82	-------	--	VIe-U	18
HpF	Hillfield-Welby silt loams, 6 to 35 percent slopes:	83				
	Hillfield	--	-------	--	VIe-U	18
	Welby	--	-------	--	IIIe-U	13
Hr	Holdaway silt loam	84	IIIw-25	13	---	--
Hs	Holdaway silt loam, strongly saline-alkali	84	-------	--	VIIw-285	21
Ir	Ironton loam	85	IIw-2	11	---	--
Is	Ironton loam, moderately saline-alkali	85	IIIw-27	14	---	--
Jo	Jordan silt loam	86	-------	--	VIIw-285	21
KeA	Keigley silty clay loam, 0 to 1 percent slopes	87	IIc-2	11	---	--
KeB	Keigley silty clay loam, 1 to 3 percent slopes	87	IIe-2	10	---	--
KgA	Keigley silty clay loam, extended season, 0 to 2 percent slopes	88	I-1	9	---	--
KmA	Kidman very fine sandy loam, 0 to 1 percent slopes	88	I-1	9	---	--
KmB	Kidman very fine sandy loam, 1 to 3 percent slopes	89	IIe-1	10	---	--
KmC	Kidman very fine sandy loam, 3 to 6 percent slopes	89	IIIe-1	11	---	--
Ks	Kirkham silty clay loam	91	IIw-2	11	---	--
Kt	Kirkham silty clay loam, moderately saline-alkali	91	IIIw-27	14	---	--
Ku	Kirkham silty clay loam, strongly saline-alkali	91	-------	--	VIIw-285	21
LaC	Lakewin gravelly fine sandy loam, 1 to 6 percent slopes	92	IVs-14	16	---	--
LaD	Lakewin gravelly fine sandy loam, 6 to 15 percent slopes	93	IVs-14	16	---	--
LcE	Lakewin cobbly fine sandy loam, 15 to 30 percent slopes	92	-------	--	VIs-U4	19
LeD	Layton loamy fine sand, 6 to 15 percent slopes	94	IVs-14	16	---	--
LfC	Layton fine sandy loam, 1 to 6 percent slopes	93	IIIs-14	14	---	--
LmA	Layton fine sandy loam, slowly permeable substratum, 0 to 1 percent slopes	94	IIIs-26	15	---	--
LnB	Layton fine sandy loam, water table, 1 to 3 percent slopes	94	IIIs-26	15	---	--
Lo	Logan silty clay loam	95	IVw-25	16	---	--
Ls	Logan silty clay loam, heavy variant	95	IVw-25	16	---	--
Mf	Martini fine sandy loam	97	IIw-2	11	---	--
Mh	McBeth silt loam	98	IIw-2	11	---	--
Mn	McBeth silt loam, moderately saline	98	IIIw-27	14	---	--
MrC	McMurdie silt loam, 3 to 6 percent slopes	99	--------	--	IIIe-U	13
MtE2	McMurdie-Taylorsville complex, 6 to 20 percent slopes, eroded:	99				
	McMurdie	--	--------	--	IIIe-U	13
	Taylorsville	--	--------	--	VIe-U	18
PaB	Parleys loam, 0 to 3 percent slopes	102	I-1	9	IIIe-U	13
PaC	Parleys loam, 3 to 6 percent slopes	102	IIe-1	10	IIIe-U	13
PbC	Parleys gravelly loam, overwashed, 3 to 6 percent slopes	101	IIIe-1	11	---	--
PcB	Parleys silty clay loam, 0 to 3 percent slopes	102	I-1	9	IIIe-U	13
Pd	Payson silty clay loam	103	--------	--	VIIw-285	21
Pf	Peteetneet peat	104	--------	--	VIIw-22	21
Pg	Peteetneet-Holdaway complex	104	--------	--	VIIw-22	21
PlC	Pleasant Grove gravelly loam, 3 to 6 percent slopes	107	IIIs-14	14	---	--
PlD	Pleasant Grove gravelly loam, 6 to 10 percent slopes	108	IIIe-14	12	IVe-UX	15
PmE2	Pleasant Grove stony loam, 10 to 25 percent slopes, eroded	108	IVs-14	16	VIs-U4	19
PnA	Pleasant Vale loam, 0 to 2 percent slopes	109	IIc-2	11	---	--
PoA	Pleasant Vale loam, extended season, 0 to 2 percent slopes	110	I-1	9	---	--
PoC	Pleasant Vale loam, extended season, 3 to 6 percent slopes	110	IIIe-1	11	---	--
PpB	Pleasant Vale gravelly loam, extended season, 1 to 3 percent slopes	109	IIe-1	10	---	--
PrD	Pleasant Vale gravelly sandy loam, extended season, 6 to 10 percent slopes	109	--------	--	IVe-UX	15
PsB	Pleasant Vale silty clay loam, 1 to 3 percent slopes	110	IIe-2	10	---	--
PtB	Pleasant View fine sandy loam, 1 to 3 percent slopes	111	IIIs-14	14	---	--
PuD	Preston fine sand, 1 to 10 percent slopes	112	IVs-14	16	---	--
Pv	Preston loamy fine sand, high water table variant	112	IVw-24	16	---	--
Pw	Provo gravelly fine sandy loam	113	IVw-24	16	---	--
Px	Provo-Sunset complex	113	IVw-24	16	---	--
Pz	Provo Bay silty clay loam	114	--------	--	Vw-22	17
RdA	Redola loam, 0 to 3 percent slopes	117	IIc-2	11	---	--
ReC	Redola gravelly loam, 3 to 6 percent slopes	117	--------	--	IIIe-U	13
Sd	Steed sandy loam	118	IVs-14	16	---	--
Se	Steed gravelly sandy loam	118	IVs-14	16	VIs-U4	19
SgB	Sterling gravelly fine sandy loam, 1 to 3 percent slopes	119	IVs-14	16	---	--
SgC	Sterling gravelly fine sandy loam, 3 to 6 percent slopes	119	IVs-14	16	---	--
SgD	Sterling gravelly fine sandy loam, 6 to 10 percent slopes	119	IVs-14	16	---	--
So	Sunset loamy fine sand	121	IVw-24	16	---	--

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HIGH INTENSITY -- Continued

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page
Sr	Sunset loam	120	IIw-2	11	--------	--
Ss	Sunset loam, gravelly substratum	121	IIw-2	11	--------	--
St	Sunset loam, clay substratum	120	IIw-2	11	--------	--
Su	Sunset loam, moderately saline	121	IIIw-27	14	--------	--
TaA	Taylorsville silty clay loam, 0 to 1 percent slopes	122	IIIe-25	12	--------	--
TaB	Taylorsville silty clay loam, 1 to 3 percent slopes	122	IIIe-25	12	--------	--
TcA	Taylorsville silty clay loam, extended season, 0 to 1 percent slopes	122	IIIe-25	12	--------	--
TcB	Taylorsville silty clay loam, extended season, 1 to 3 percent slopes	122	IIIe-25	12	IIIe-U	13
TcC2	Taylorsville silty clay loam, extended season, 3 to 6 percent slopes, eroded	123	--------	--	IIIe-U	13
TmB	Timpanogos loam, 0 to 3 percent slopes	123	I-1	9	--------	--
TmC	Timpanogos loam, 3 to 6 percent slopes	124	IIe-1	10	IIIe-U	13
ToB	Timpanogos loam, water table, 0 to 3 percent slopes	124	I-1	9	--------	--
VnA	Vineyard fine sandy loam, 0 to 2 percent slopes	125	IIw-2	11	--------	--
VsA	Vineyard fine sandy loam, moderately saline, 0 to 2 percent slopes	125	IIIw-27	14	--------	--
WbA	Welby silt loam, 0 to 1 percent slopes	126	IIc-2	11	--------	--
WbB	Welby silt loam, 1 to 3 percent slopes	126	IIe-2	10	--------	--
WbC	Welby silt loam, 3 to 6 percent slopes	126	IIIe-1	11	--------	--
WeA	Welby silt loam, extended season, 0 to 1 percent slopes	126	I-1	9	--------	--
WeB	Welby silt loam, extended season, 1 to 3 percent slopes	126	IIe-1	10	IIIe-U	13
WeC	Welby silt loam, extended season, 3 to 6 percent slopes	127	IIIe-1	11	IIIe-U	13
WeD2	Welby silt loam, extended season, 6 to 10 percent slopes, eroded	127	--------	--	IIIe-U	13
WhD	Welby-Hillfield silt loams, 6 to 10 percent slopes	127	--------	--	IIIe-U	13
WhE	Welby-Hillfield silt loams, 10 to 30 percent slopes	127	--------	--	VIe-U	18

LOW INTENSITY

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page
AR	Arave silt loam	68	--------	--	VIIw-285	21
BC	Beaches	68	--------	--	VIIIw-2	23
CU	Cobbly alluvial land	75	--------	--	VIIs-UX4	22
DCF	Dry Creek cobbly loam, 10 to 30 percent slopes	77	--------	--	VIe-U	18
DEF	Dry Creek extremely stony loam, stony subsoil variant, 6 to 30 percent slopes	79	--------	--	VIIs-UX4	22
DRG2	Dry Creek cobbly loam, thin surface variant, 30 to 60 percent slopes, eroded	78	--------	--	VIIe-U	20
GAG	Gappmayer cobbly loam, 50 to 70 percent slopes	80	--------	--	VIIe-M	20
HEG	Henefer loam, 35 to 70 percent slopes	81	--------	--	VIIe-M	20
HFF	Henefer-McPhie association, 5 to 30 percent slopes	81	--------	--	VIe-M	18
HFG2	Henefer-McPhie association, 30 to 60 percent slopes, eroded	81	--------	--	VIIe-M	20
HKG	Henefer-Rake association, 35 to 70 percent slopes:	81				
	Henefer	--	--------	--	VIIe-M	20
	Rake	--	--------	--	VIIs-UX3	22
HNG	Hillfield-Layton complex, 30 to 60 percent slopes	83	--------	--	VIIe-U	20
HOF	Hillfield-Sterling complex, 20 to 35 percent slopes:	83				
	Hillfield	--	--------	--	VIe-U	18
	Sterling	--	--------	--	VIs-U4	19
HNG2	Kilburn very gravelly sandy loam, 30 to 50 percent slopes, eroded	90	--------	--	VIIs-UX4	22
KOD	Kilburn stony sandy loam, 3 to 15 percent slopes	90	--------	--	VIs-U4	19
KRE2	Kilburn gravelly fine sandy loam, 15 to 30 percent slopes, eroded	90	--------	--	VIs-U4	19
MAF	Manila silt loam, 10 to 30 percent slopes	96	--------	--	VIe-M	18
MU	Mixed alluvial land	100	--------	--	VIw-25	19
MX	Mixed alluvial land, saline	101	--------	--	VIIIw-8	23
PEE	Payson-Terrace escarpments complex, 1 to 20 percent slopes:	103				
	Payson	---	--------	--	VIIw-285	21
	Terrace escarpments	---	--------	--	VIIIw-8	23
PHG2	Picayune cobbly silt loam, 35 to 70 percent slopes, eroded	105	--------	--	VIIe-M	20
PIF	Picayune cobbly loam, red variant, 30 to 60 percent slopes	106	--------	--	VIIe-M	20
PJG2	Picayune-Rake association, 35 to 70 percent slopes, eroded:	106				
	Picayune	---	--------	--	VIIe-M	20
	Rake	---	--------	--	VIIs-UX3	22
Pk	Pits and Dumps	107	--------	--	VIIIs-4	23
PNG2	Pleasant Grove-Terrace escarpments complex, 30 to 60 percent slopes, eroded	108				
	Pleasant Grove stony sandy loam, 30 to 60 percent slopes, eroded	---	--------	--	VIIs-UX4	22
	Terrace escarpments	---	--------	--	VIIIs-4	23
PY	Provo Bay peaty silt loam	114	--------	--	VIIIw-2	23
RAG2	Rake extremely stony loam, 20 to 70 percent slopes, eroded	115	--------	--	VIIs-UX3	22
RV	Riverwash	117	--------	--	VIIIw-4	23
RW	Rock land	117	--------	--	VIIIs-X	23
SNG	Sterling-Terrace escarpments complex, 30 to 70 percent slopes:	119				
	Sterling	---	--------	--	VIIs-UX4	22
	Terrace escarpments	---	--------	--	VIIIs-4	23

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SOIL ASSOCIATIONS*

1. Chipman-McBeth association: Poorly drained, nearly level, loamy soils on low lake terraces
2. Payson-Logan, heavy variant-Arave association: Moderately well drained to poorly drained, nearly level, mainly saline-alkali, loamy and clayey soils on low lake terraces
3. Taylorsville-Welby association: Well-drained, nearly level to moderately steep, loamy soils on intermediate lake terraces
4. Pleasant Vale-Kirkham-Sunset association: Well-drained and somewhat poorly drained, nearly level to gently sloping, loamy soils on flood plains
5. Steed-Pleasant Vale-Redola association: Well-drained, nearly level to gently sloping, gravelly, loamy soils on flood plains and alluvial fans
6. Benjamin-Kirkham association: Somewhat poorly drained, nearly level, saline-alkali, clayey and loamy soils on flood plains and alluvial fans
7. Bingham-Parleys association: Well-drained, nearly level to moderately sloping, gravelly, loamy soils on intermediate and high lake terraces
8. Pleasant Grove-Cleverly-Kilburn association: Well-drained, gently sloping to steep, gravelly or stony, loamy soils on intermediate and high lake terraces
9. Lakewin-Layton association: Well drained and moderately well drained, nearly level to moderately steep, gravelly, sandy, and loamy soils on lake terraces and terrace escarpments
10. Welby-Hillfield association: Well-drained, gently sloping to steep, loamy soils on high lake terraces
11. Henefer-Manila-Dry Creek association: Well-drained, moderately sloping to very steep soils that have a clayey subsoil; mainly on mountains
12. Rake-Picayune association: Well-drained, steep and very steep, stony and cobbly, loamy soils on hillsides and mountains

* The texture given is that of the surface layer of the major soil or soils in the association.

Published 1971

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

UTAH AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

UTAH COUNTY, UTAH — CENTRAL PART

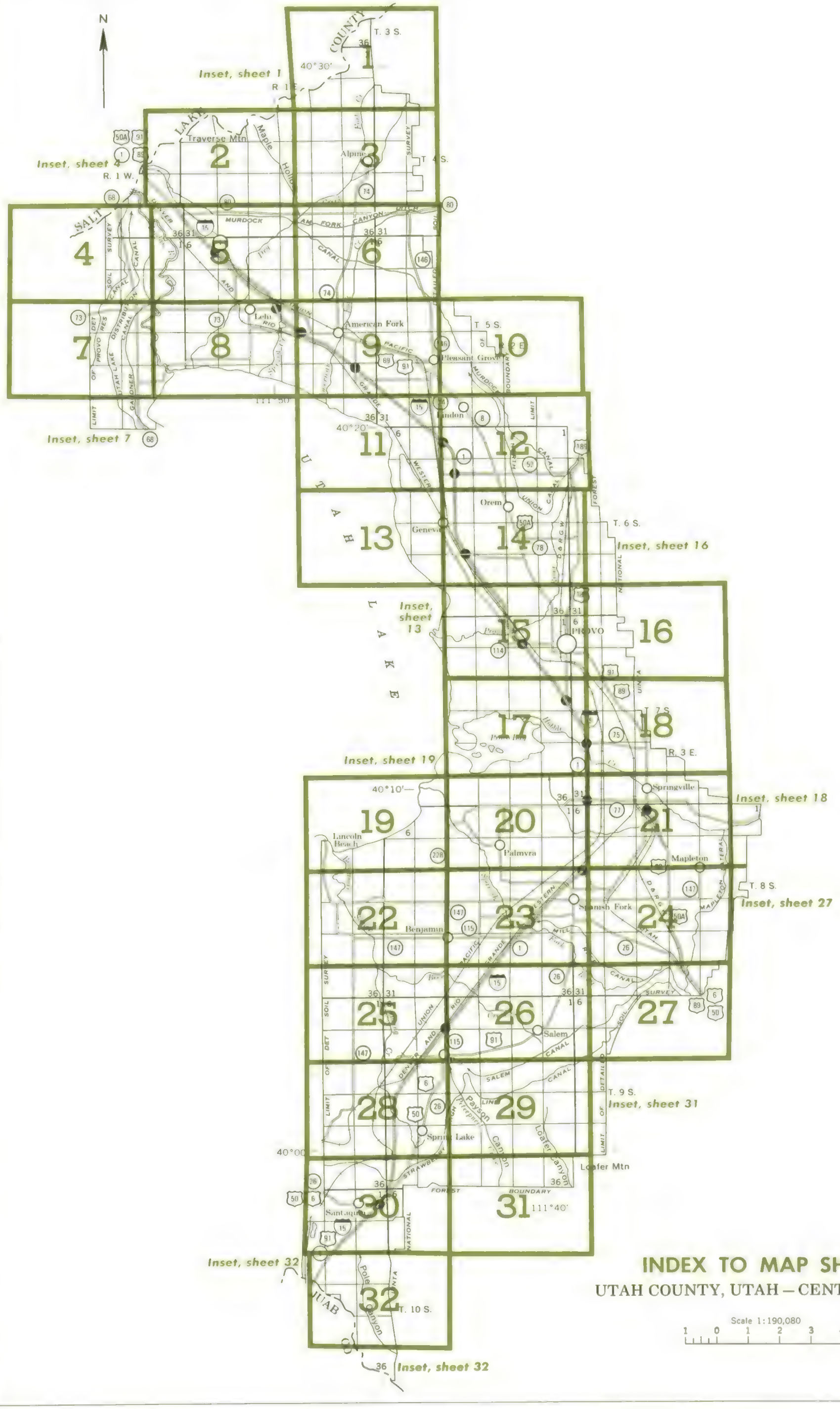
Scale 1:190,080

1 0 1 2 3 4 Miles

This map is for general planning. It shows only the major soils and does not contain sufficient detail for operational planning.

INDEX TO MAP SHEETS

UTAH COUNTY, UTAH — CENTRAL PART



Scale 1:190,080

GUIDE TO MAPPING UNITS

[For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. For complete information about a capability unit, read both the introduction to "Crops and Pasture" and the discussion of the capability unit in this section. For information about wildlife suitability groups, see the section beginning on page 24. Other information is given in tables as follows: Estimated yields of principal crops, pasture, and fruit trees, table 1, page 26. Use of the soils in engineering, table 2, page 34; table 3, page 44; and table 4, page 60. Acreage and extent, table 5, page 64]

HIGH INTENSITY

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page
Bd	Benjamin silty clay	69	IIIw-25	13	---	--
Be	Benjamin silty clay, moderately alkali	69	-------	--	VIIw-285	21
Bf	Benjamin silty clay, strongly alkali	70	-------	--	VIIw-285	21
Bg	Benjamin silty clay, sandy substratum	70	IIIw-25	13	---	--
BhB	Bingham loam, 1 to 3 percent slopes	71	IIIs-14	14	---	--
BkB	Bingham gravelly loam, 1 to 3 percent slopes	71	IVs-14	16	---	--
BmC	Bingham cobbly loam, 3 to 6 percent slopes	71	IVs-14	16	IVe-UX	15
BmD	Bingham cobbly loam, 6 to 10 percent slopes	71	IVs-14	16	IVe-UX	15
Br	Bramwell silty clay loam	72	IIIw-27	14	---	--
Bs	Bramwell silty clay loam, drained	72	IIIw-25	13	---	--
Ch	Chipman loam	73	IIw-2	11	---	--
Ck	Chipman silty clay loam	73	IIw-2	11	---	--
Cm	Chipman silty clay loam, moderately deep water table	74	IVw-25	16	---	--
Cn	Chipman silty clay loam, moderately saline	74	IIIw-27	14	---	--
Co	Chipman silty clay loam, strongly saline	74	-------	--	VIIw-285	21
Cp	Chipman-McBeth complex	74	IVw-25	16	---	--
CrD	Cleverly cobbly sandy loam, 6 to 15 percent slopes	75	IVs-14	16	IVe-UX	15
CsB	Cleverly gravelly fine sandy loam, 1 to 3 percent slopes	75	IIIs-14	14	IVe-UX	15
CsC	Cleverly gravelly fine sandy loam, 3 to 6 percent slopes	75	IIIs-14	14	IVe-UX	15
CsD	Cleverly gravelly fine sandy loam, 6 to 15 percent slopes	75	IIIe-14	12	IVe-UX	15
Da	Dagor loam	76	I-1	9	IIIe-U	13
Db	Dagor silt loam	76	I-1	9	IIIe-U	13
HmE	Hillfield silt loam, 10 to 20 percent slopes	82	-------	--	VIe-U	18
HmF	Hillfield silt loam, 20 to 30 percent slopes	82	-------	--	VIe-U	18
HpF	Hillfield-Welby silt loams, 6 to 35 percent slopes:	83				
	Hillfield	--	-------	--	VIe-U	18
	Welby	--	-------	--	IIIe-U	13
Hr	Holdaway silt loam	84	IIIw-25	13	---	--
Hs	Holdaway silt loam, strongly saline-alkali	84	-------	--	VIIw-285	21
Ir	Ironton loam	85	IIw-2	11	---	--
Is	Ironton loam, moderately saline-alkali	85	IIIw-27	14	---	--
Jo	Jordan silt loam	86	-------	--	VIIw-285	21
KeA	Keigley silty clay loam, 0 to 1 percent slopes	87	IIc-2	11	---	--
KeB	Keigley silty clay loam, 1 to 3 percent slopes	87	IIe-2	10	---	--
KgA	Keigley silty clay loam, extended season, 0 to 2 percent slopes	88	I-1	9	---	--
KmA	Kidman very fine sandy loam, 0 to 1 percent slopes	88	I-1	9	---	--
KmB	Kidman very fine sandy loam, 1 to 3 percent slopes	89	IIe-1	10	---	--
KmC	Kidman very fine sandy loam, 3 to 6 percent slopes	89	IIIe-1	11	---	--
Ks	Kirkham silty clay loam	91	IIw-2	11	---	--
Kt	Kirkham silty clay loam, moderately saline-alkali	91	IIIw-27	14	---	--
Ku	Kirkham silty clay loam, strongly saline-alkali	91	-------	--	VIIw-285	21
LaC	Lakewin gravelly fine sandy loam, 1 to 6 percent slopes	92	IVs-14	16	---	--
LaD	Lakewin gravelly fine sandy loam, 6 to 15 percent slopes	93	IVs-14	16	---	--
LcE	Lakewin cobbly fine sandy loam, 15 to 30 percent slopes	92	-------	--	VIs-U4	19
LeD	Layton loamy fine sand, 6 to 15 percent slopes	94	IVs-14	16	---	--
LfC	Layton fine sandy loam, 1 to 6 percent slopes	93	IIIs-14	14	---	--
LmA	Layton fine sandy loam, slowly permeable substratum, 0 to 1 percent slopes	94	IIIs-26	15	---	--
LnB	Layton fine sandy loam, water table, 1 to 3 percent slopes	94	IIIs-26	15	---	--
Lo	Logan silty clay loam	95	IVw-25	16	---	--
Ls	Logan silty clay loam, heavy variant	95	IVw-25	16	---	--
Mf	Martini fine sandy loam	97	IIw-2	11	---	--
Mh	McBeth silt loam	98	IIw-2	11	---	--
Mn	McBeth silt loam, moderately saline	98	IIIw-27	14	---	--
MrC	McMurdie silt loam, 3 to 6 percent slopes	99	--------	--	IIIe-U	13
MtE2	McMurdie-Taylorsville complex, 6 to 20 percent slopes, eroded:	99				
	McMurdie	--	--------	--	IIIe-U	13
	Taylorsville	--	--------	--	VIe-U	18
PaB	Parleys loam, 0 to 3 percent slopes	102	I-1	9	IIIe-U	13
PaC	Parleys loam, 3 to 6 percent slopes	102	IIe-1	10	IIIe-U	13
PbC	Parleys gravelly loam, overwashed, 3 to 6 percent slopes	101	IIIe-1	11	---	--
PcB	Parleys silty clay loam, 0 to 3 percent slopes	102	I-1	9	IIIe-U	13
Pd	Payson silty clay loam	103	--------	--	VIIw-285	21
Pf	Peteetneet peat	104	--------	--	VIIw-22	21
Pg	Peteetneet-Holdaway complex	104	--------	--	VIIw-22	21
PlC	Pleasant Grove gravelly loam, 3 to 6 percent slopes	107	IIIs-14	14	---	--
PlD	Pleasant Grove gravelly loam, 6 to 10 percent slopes	108	IIIe-14	12	IVe-UX	15
PmE2	Pleasant Grove stony loam, 10 to 25 percent slopes, eroded	108	IVs-14	16	VIs-U4	19
PnA	Pleasant Vale loam, 0 to 2 percent slopes	109	IIc-2	11	---	--
PoA	Pleasant Vale loam, extended season, 0 to 2 percent slopes	110	I-1	9	---	--
PoC	Pleasant Vale loam, extended season, 3 to 6 percent slopes	110	IIIe-1	11	---	--
PpB	Pleasant Vale gravelly loam, extended season, 1 to 3 percent slopes	109	IIe-1	10	---	--
PrD	Pleasant Vale gravelly sandy loam, extended season, 6 to 10 percent slopes	109	--------	--	IVe-UX	15
PsB	Pleasant Vale silty clay loam, 1 to 3 percent slopes	110	IIe-2	10	---	--
PtB	Pleasant View fine sandy loam, 1 to 3 percent slopes	111	IIIs-14	14	---	--
PuD	Preston fine sand, 1 to 10 percent slopes	112	IVs-14	16	---	--
Pv	Preston loamy fine sand, high water table variant	112	IVw-24	16	---	--
Pw	Provo gravelly fine sandy loam	113	IVw-24	16	---	--
Px	Provo-Sunset complex	113	IVw-24	16	---	--
Pz	Provo Bay silty clay loam	114	--------	--	Vw-22	17
RdA	Redola loam, 0 to 3 percent slopes	117	IIc-2	11	---	--
ReC	Redola gravelly loam, 3 to 6 percent slopes	117	--------	--	IIIe-U	13
Sd	Steed sandy loam	118	IVs-14	16	---	--
Se	Steed gravelly sandy loam	118	IVs-14	16	VIs-U4	19
SgB	Sterling gravelly fine sandy loam, 1 to 3 percent slopes	119	IVs-14	16	---	--
SgC	Sterling gravelly fine sandy loam, 3 to 6 percent slopes	119	IVs-14	16	---	--
SgD	Sterling gravelly fine sandy loam, 6 to 10 percent slopes	119	IVs-14	16	---	--
So	Sunset loamy fine sand	121	IVw-24	16	---	--

422-923 O - 71 (Follows text) No. 2

HIGH INTENSITY -- Continued

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page
Sr	Sunset loam	120	IIw-2	11	--------	--
Ss	Sunset loam, gravelly substratum	121	IIw-2	11	--------	--
St	Sunset loam, clay substratum	120	IIw-2	11	--------	--
Su	Sunset loam, moderately saline	121	IIIw-27	14	--------	--
TaA	Taylorsville silty clay loam, 0 to 1 percent slopes	122	IIIe-25	12	--------	--
TaB	Taylorsville silty clay loam, 1 to 3 percent slopes	122	IIIe-25	12	--------	--
TcA	Taylorsville silty clay loam, extended season, 0 to 1 percent slopes	122	IIIe-25	12	--------	--
TcB	Taylorsville silty clay loam, extended season, 1 to 3 percent slopes	122	IIIe-25	12	IIIe-U	13
TcC2	Taylorsville silty clay loam, extended season, 3 to 6 percent slopes, eroded	123	--------	--	IIIe-U	13
TmB	Timpanogos loam, 0 to 3 percent slopes	123	I-1	9	--------	--
TmC	Timpanogos loam, 3 to 6 percent slopes	124	IIe-1	10	IIIe-U	13
ToB	Timpanogos loam, water table, 0 to 3 percent slopes	124	I-1	9	--------	--
VnA	Vineyard fine sandy loam, 0 to 2 percent slopes	125	IIw-2	11	--------	--
VsA	Vineyard fine sandy loam, moderately saline, 0 to 2 percent slopes	125	IIIw-27	14	--------	--
WbA	Welby silt loam, 0 to 1 percent slopes	126	IIc-2	11	--------	--
WbB	Welby silt loam, 1 to 3 percent slopes	126	IIe-2	10	--------	--
WbC	Welby silt loam, 3 to 6 percent slopes	126	IIIe-1	11	--------	--
WeA	Welby silt loam, extended season, 0 to 1 percent slopes	126	I-1	9	--------	--
WeB	Welby silt loam, extended season, 1 to 3 percent slopes	126	IIe-1	10	IIIe-U	13
WeC	Welby silt loam, extended season, 3 to 6 percent slopes	127	IIIe-1	11	IIIe-U	13
WeD2	Welby silt loam, extended season, 6 to 10 percent slopes, eroded	127	--------	--	IIIe-U	13
WhD	Welby-Hillfield silt loams, 6 to 10 percent slopes	127	--------	--	IIIe-U	13
WhE	Welby-Hillfield silt loams, 10 to 30 percent slopes	127	--------	--	VIe-U	18

LOW INTENSITY

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page
AR	Arave silt loam	68	--------	--	VIIw-285	21
BC	Beaches	68	--------	--	VIIIw-2	23
CU	Cobbly alluvial land	75	--------	--	VIIs-UX4	22
DCF	Dry Creek cobbly loam, 10 to 30 percent slopes	77	--------	--	VIe-U	18
DEF	Dry Creek extremely stony loam, stony subsoil variant, 6 to 30 percent slopes	79	--------	--	VIIs-UX4	22
DRG2	Dry Creek cobbly loam, thin surface variant, 30 to 60 percent slopes, eroded	78	--------	--	VIIe-U	20
GAG	Gappmayer cobbly loam, 50 to 70 percent slopes	80	--------	--	VIIe-M	20
HEG	Henefer loam, 35 to 70 percent slopes	81	--------	--	VIIe-M	20
HFF	Henefer-McPhie association, 5 to 30 percent slopes	81	--------	--	VIe-M	18
HFG2	Henefer-McPhie association, 30 to 60 percent slopes, eroded	81	--------	--	VIIe-M	20
HKG	Henefer-Rake association, 35 to 70 percent slopes:	81				
	Henefer	--	--------	--	VIIe-M	20
	Rake	--	--------	--	VIIs-UX3	22
HNG	Hillfield-Layton complex, 30 to 60 percent slopes	83	--------	--	VIIe-U	20
HOF	Hillfield-Sterling complex, 20 to 35 percent slopes:	83				
	Hillfield	--	--------	--	VIe-U	18
	Sterling	--	--------	--	VIs-U4	19
HNG2	Kilburn very gravelly sandy loam, 30 to 50 percent slopes, eroded	90	--------	--	VIIs-UX4	22
KOD	Kilburn stony sandy loam, 3 to 15 percent slopes	90	--------	--	VIs-U4	19
KRE2	Kilburn gravelly fine sandy loam, 15 to 30 percent slopes, eroded	90	--------	--	VIs-U4	19
MAF	Manila silt loam, 10 to 30 percent slopes	96	--------	--	VIe-M	18
MU	Mixed alluvial land	100	--------	--	VIw-25	19
MX	Mixed alluvial land, saline	101	--------	--	VIIIw-8	23
PEE	Payson-Terrace escarpments complex, 1 to 20 percent slopes:	103				
	Payson	---	--------	--	VIIw-285	21
	Terrace escarpments	---	--------	--	VIIIw-8	23
PHG2	Picayune cobbly silt loam, 35 to 70 percent slopes, eroded	105	--------	--	VIIe-M	20
PIF	Picayune cobbly loam, red variant, 30 to 60 percent slopes	106	--------	--	VIIe-M	20
PJG2	Picayune-Rake association, 35 to 70 percent slopes, eroded:	106				
	Picayune	---	--------	--	VIIe-M	20
	Rake	---	--------	--	VIIs-UX3	22
Pk	Pits and Dumps	107	--------	--	VIIIs-4	23
PNG2	Pleasant Grove-Terrace escarpments complex, 30 to 60 percent slopes, eroded	108				
	Pleasant Grove stony sandy loam, 30 to 60 percent slopes, eroded	---	--------	--	VIIs-UX4	22
	Terrace escarpments	---	--------	--	VIIIs-4	23
PY	Provo Bay peaty silt loam	114	--------	--	VIIIw-2	23
RAG2	Rake extremely stony loam, 20 to 70 percent slopes, eroded	115	--------	--	VIIs-UX3	22
RV	Riverwash	117	--------	--	VIIIw-4	23
RW	Rock land	117	--------	--	VIIIs-X	23
SNG	Sterling-Terrace escarpments complex, 30 to 70 percent slopes:	119				
	Sterling	---	--------	--	VIIs-UX4	22
	Terrace escarpments	---	--------	--	VIIIs-4	23

422-923 O - 71 (Follows text) No. 1

SOIL LEGEND

The first letter, always a capital, is the initial one of the soil name. The second letter is a capital if the mapping unit is one of the low intensity survey; otherwise it is a small letter. The third letter, always a capital A, B, C, D, E, F, or G, shows the slope. Most symbols without a slope letter are for nearly level soils or land types, but some are for land types that have a considerable range in slope. A final number, 2, in the symbol shows that the soil is eroded.

HIGH INTENSITY [1]

SYMBOL	NAME
	Benjamin silty clay
	Benjamin silty clay, moderately alkali
	Benjamin silty clay, strongly alkali
	Benjamin silty clay, sandy substratum
	Bingham loam, 1 to 3 percent slopes
	Bingham gravelly loam, 1 to 3 percent slopes
	Bingham cobbly loam, 3 to 6 percent slopes
	Bingham cobbly loam, 6 to 10 percent slopes
	Bramwell silty clay loam
	Bramwell silty clay loam, drained
	Chipman loam
	Chipman silty clay loam
	Chipman silty clay loam, moderately deep water table
	Chipman silty clay loam, moderately saline
	Chipman silty clay loam, strongly saline
	Chipman-McBeth complex
	Cleverly cobbly sandy loam, 6 to 15 percent slopes
	Cleverly gravelly fine sandy loam, 1 to 3 percent slopes
	Cleverly gravelly fine sandy loam, 3 to 6 percent slopes
	Cleverly gravelly fine sandy loam, 6 to 15 percent slopes
	Dagor loam
	Dagor silt loam
	Hillfield silt loam, 10 to 20 percent slopes
	Hillfield silt loam, 20 to 30 percent slopes
	Hillfield-Welby silt loams, 6 to 35 percent slopes
	Holdaway silt loam
	Holdaway silt loam, strongly saline-alkali
	Ironton loam
	Ironton loam, moderately saline-alkali
	Jordan silt loam
	Keigley silty clay loam, 0 to 1 percent slopes
	Keigley silty clay loam, 1 to 3 percent slopes
	Keigley silty clay loam, extended season, 0 to 2 percent slopes
	Kidman very fine sandy loam, 0 to 1 percent slopes
	Kidman very fine sandy loam, 1 to 3 percent slopes
	Kidman very fine sandy loam, 3 to 6 percent slopes
	Kirkham silty clay loam
	Kirkham silty clay loam, moderately saline-alkali
	Kirkham silty clay loam, strongly saline-alkali
	Lakewin gravelly fine sandy loam, 1 to 6 percent slopes
	Lakewin gravelly fine sandy loam, 6 to 15 percent slopes
	Lakewin cobbly fine sandy loam, 15 to 30 percent slopes
	Layton loamy fine sand, 6 to 15 percent slopes
	Layton fine sandy loam, 1 to 6 percent slopes
	Layton fine sandy loam, slowly permeable substratum, 0 to 1 percent slopes
	Layton fine sandy loam, water table, 1 to 3 percent slopes
	Logan silty clay loam
	Logan silty clay loam, heavy variant
	Martini fine sandy loam
	McBeth silt loam
	McBeth silt loam, moderately saline
	McMurdie silt loam, 3 to 6 percent slopes
	McMurdie-Taylorsville complex, 6 to 20 percent slopes, eroded
	Parleys loam, 0 to 3 percent slopes
	Parleys loam, 3 to 6 percent slopes
	Parleys gravelly loam, overwashed, 3 to 6 percent slopes
	Parleys silty clay loam, 0 to 3 percent slopes
	Payson silty clay loam
	Peteetneet peat
	Peteetneet-Holdaway complex
	Pleasant Grove gravelly loam, 3 to 6 percent slopes
	Pleasant Grove gravelly loam, 6 to 10 percent slopes
	Pleasant Grove stony loam, 10 to 25 percent slopes, eroded
	Pleasant Vale loam, 0 to 2 percent slopes
	Pleasant Vale loam, extended season, 0 to 2 percent slopes
	Pleasant Vale loam, extended season, 3 to 6 percent slopes
	Pleasant Vale gravelly loam, extended season, 1 to 3 percent slopes
	Pleasant Vale gravelly sandy loam, extended season, 6 to 10 percent slopes
	Pleasant Vale silty clay loam, 1 to 3 percent slopes
	Pleasant View fine sandy loam, 1 to 3 percent slopes
	Preston fine sand, 1 to 10 percent slopes
	Preston loamy fine sand, high water table variant
	Provo gravelly fine sandy loam
	Provo-Sunset complex
	Provo Bay silty clay loam
	Redola loam, 0 to 3 percent slopes
	Redola gravelly loam, 3 to 6 percent slopes
	Steed sandy loam
	Steed gravelly sandy loam
	Sterling gravelly fine sandy loam, 1 to 3 percent slopes
	Sterling gravelly fine sandy loam, 3 to 6 percent slopes
	Sterling gravelly fine sandy loam, 6 to 10 percent slopes
	Sunset loamy fine sand
	Sunset loam
	Sunset loam, gravelly substratum
	Sunset loam, clay substratum
	Sunset loam, moderately saline
	Taylorsville silty clay loam, 0 to 1 percent slopes
	Taylorsville silty clay loam, 1 to 3 percent slopes
	Taylorsville silty clay loam, extended season, 0 to 1 percent slopes
	Taylorsville silty clay loam, extended season, 1 to 3 percent slopes
	Taylorsville silty clay loam, extended season, 3 to 6 percent slopes, eroded
	Timpanogos loam, 0 to 3 percent slopes
	Timpanogos loam, 3 to 6 percent slopes
	Timpanogos loam, water table, 0 to 3 percent slopes
	Vineyard fine sandy loam, 0 to 2 percent slopes
	Vineyard fine sandy loam, moderately saline, 0 to 2 percent slopes
	Welby silt loam, 0 to 1 percent slopes
	Welby silt loam, 1 to 3 percent slopes
	Welby silt loam, 3 to 6 percent slopes
	Welby silt loam, extended season, 0 to 1 percent slopes
	Welby silt loam, extended season, 1 to 3 percent slopes
	Welby silt loam, extended season, 3 to 6 percent slopes
WeD2	Welby silt loam, extended season, 6 to 10 percent slopes, eroded
WhD	Welby-Hillfield silt loams, 6 to 10 percent slopes
WhE	Welby-Hillfield silt loams, 10 to 30 percent slopes

[1] Each mapping unit is relatively homogeneous with few inclusions of soils other than those indicated by the symbol and the mapping unit name.

LOW INTENSITY [2]

SYMBOL	NAME
	Arave silt loam
	Beaches
	Cobbly alluvial land
	Dry Creek cobbly loam, 10 to 30 percent slopes
	Dry Creek extremely stony loam, stony subsoil variant, 6 to 30 percent slopes
	Dry Creek cobbly loam, thin surface variant, 30 to 60 percent slopes, eroded
	Cappmayer cobbly loam, 50 to 70 percent slopes
	Henefer loam, 35 to 70 percent slopes
	Henefer-McPhie association, 5 to 30 percent slopes
	Henefer-McPhie association, 30 to 60 percent slopes, eroded
	Henefer-Rake association, 35 to 70 percent slopes
	Hillfield-Layton complex, 30 to 60 percent slopes
	Hillfield-Sterling complex, 20 to 35 percent slopes
	Kilburn very gravelly sandy loam, 30 to 50 percent slopes, eroded
	Kilburn stony sandy loam, 3 to 15 percent slopes
	Kilburn gravelly fine sandy loam, 15 to 30 percent slopes, eroded
	Manila silt loam, 10 to 30 percent slopes
	Mixed alluvial land
	Mixed alluvial land, saline
	Payson-Terrace escarpments complex, 1 to 20 percent slopes
	Picayune cobbly silt loam, 35 to 70 percent slopes, eroded
	Picayune cobbly loam, red variant, 30 to 60 percent slopes
	Picayune-Rake association, 35 to 70 percent slopes, eroded
	Pits and Dumps
	Pleasant Grove-Terrace escarpments complex, 30 to 60 percent slopes, eroded
	Provo Bay peaty silt loam
	Rake extremely stony loam, 20 to 70 percent slopes, eroded
	Riverwash
	Rock land
	Sterling-Terrace escarpments complex, 30 to 70 percent slopes

[2] The composition of these units is more variable than that of the others in the survey area but has been controlled well enough to interpret for the expected use of the soils concerned.

Soil map constructed 1970 by Cartographic Division, Soil Conservation Service, USDA, from 1965 aerial photographs. Controlled mosaic based on Utah plane coordinate system, central zone, Lambert conformal conic projection, 1927 North American datum.

UTAH COUNTY, UTAH, CENTRAL PART — SHEET NUMBER 1

N

1 Mile
5000 Feet
Scale 1:20 000

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station
Land division corners are approximately positioned on this map.

UTAH COUNTY, UTAH, CENTRAL PART NO. 1

UTAH COUNTY, UTAH, CENTRAL PART NO. 10

Land division corners are approximately positioned on this map

Aerial photographs taken in 1970 as part of a cooperative survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station.
Land division corners are approximately positioned on this map.
UTAH COUNTY, UTAH, CENTRAL PART NO. 11

UTAH COUNTY, UTAH, CENTRAL PART NO. 12

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station
Land division corners are approximately positioned on this map.

UTAH COUNTY, UTAH, CENTRAL PART NO. 13

(Joins sheet 15)

T. 7 S | T. 6 S.

(Joins sheet 14)

T. 6 S.

(Joins sheet 11)

1 Mile
5000 Feet
Scale 1:20 000

N

UTAH COUNTY, UTAH, CENTRAL PART — SHEET NUMBER 13

14

N

1 Mile 5000 Feet

Scale 1:20 000

(Joins sheet 12)

(Joins sheet 13)

(Joins sheet 15)

(Joins sheet 16)

R. 2 E. | R. 3 E.

T. 6 S.

Geneva School

OREM

PROVO

Snow

Lincoln

Curtis

NORTH UNION CANAL

DENVER AND RIO GRANDE WESTERN

PACIFIC

Provo River

Utah Agricultural Experiment Station

UTAH COUNTY, UTAH, CENTRAL PART NO. 14

Land division corners are approximately positioned on this map

UTAH COUNTY, UTAH, CENTRAL PART — SHEET NUMBER 15

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

UTAH COUNTY, UTAH, CENTRAL PART NO. 15

UTAH COUNTY, UTAH, CENTRAL PART NO. 16

Land division corners are approximate y positioned on this map

...by the Soil Conservation Service, and the Utah Agricultural Experiment Station

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

UTAH COUNTY, UTAH, CENTRAL PART NO. 17

17

N

(Joins sheet 15)

R. 2 E. | R. 3 E.

T. 7 S.

PROVO MUNICIPAL AIRPORT

LIMIT OF DETAILED SOIL SURVEY

GOLF COURSE

SEWER PLANT

Dry Creek

Mill Race Creek

UTAH LAKE

PROVO BAY

16 15 14 13 18 21 22 23 24 19 28 27 26 25 30

BC Cn Ck Cm Mh Ss VsA PK Hs Cp Mn LnB PK PY Lo Pz MU Hs Is Pf Mh Be Hr Sr Kt Ktu MX Ks

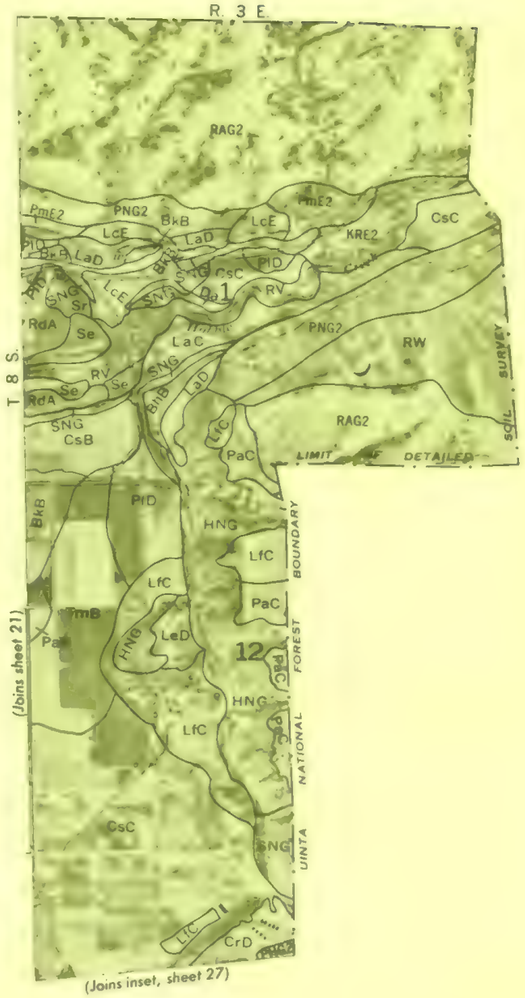
(Joins inset, sheet 19)

(Joins sheet 18)

(Joins sheet 20)

1 Mile 5000 Feet

Scale 1:20 000



UTAH COUNTY, UTAH, CENTRAL PART NO. 18
Land division corners are approximately positioned on this map

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station

N

UTAH COUNTY, UTAH, CENTRAL PART NO. 19

(Joins inset)

(Joins upper right)

(Joins sheet 17)

(Joins sheet 20)

(Joins sheet 22)

T. 8 S. | T. 7 S.

R. 1 E. | R. 2 E.

1 Mile

5000 Feet

Scale 1:20 000

UTAH LAKE

Spanish Fork River

Lincoln Beach

Benjamin Slough

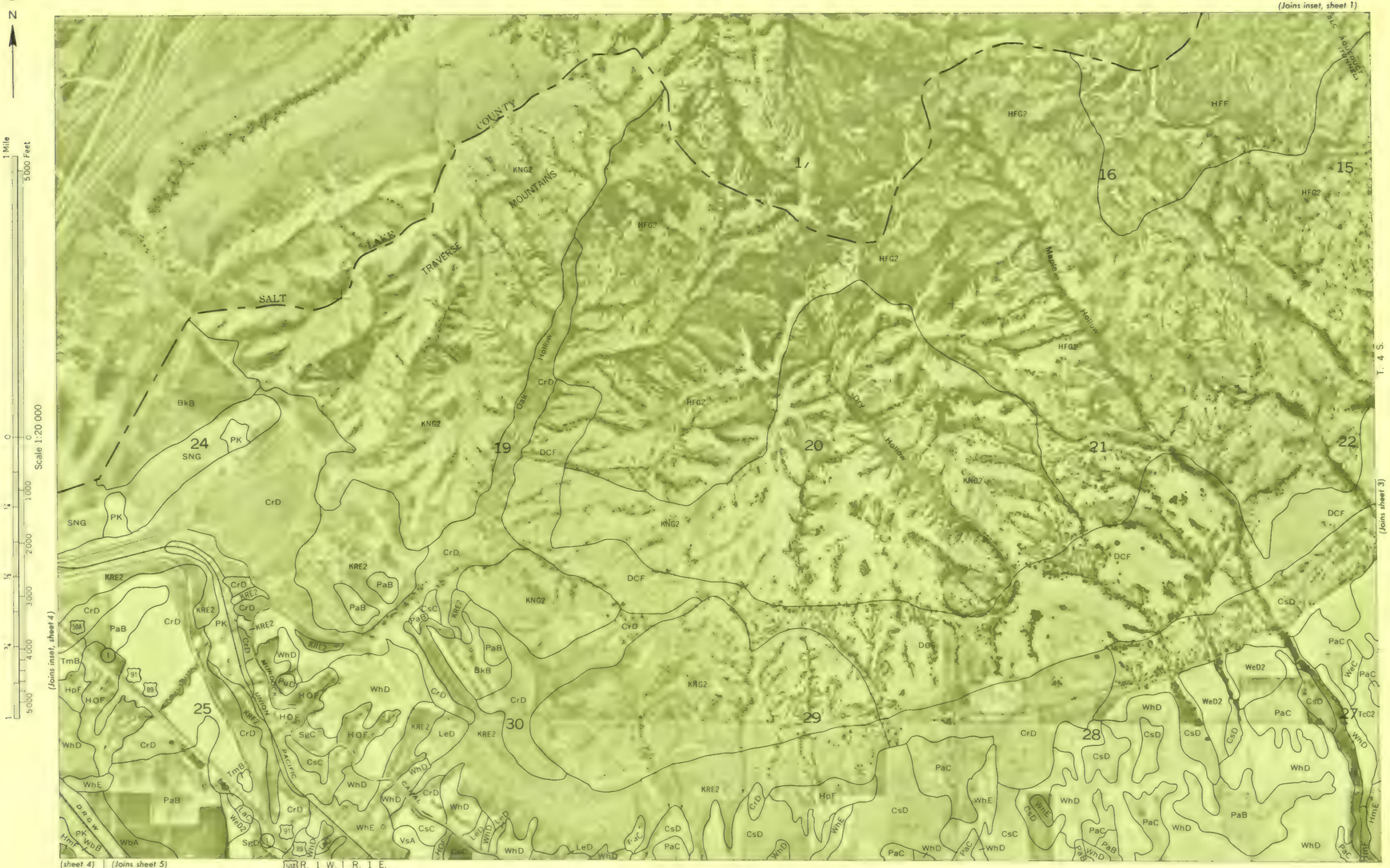
SOIL SURVEY OF DETAILED PNG2 LIMIT PID

PID

5 6 7 8 11 12 29 32

MU Su Kt Pz BC Ku Mf Sr St Ks RV MX Hs PK PIG Pf Co Bf Be Bg Bd Br Ls AR

(2)



UTAH COUNTY, UTAH, CENTRAL PART NO. 2

Land division corners are approximately positioned on this map

... of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station

N

1 Mile 5000 Feet

Scale 1:20 000

(Joins sheet 17)

(Joins sheet 19)

(Joins sheet 21)

(Joins sheet 23)

R. 2 E. | R. 3 E.

T. 8 S. | T. 7 S.

Palmyra

SPANISH FORK AIRPORT MX

Spanish Fork River

Hobble Creek

PACIFIC

UNION

UTAH COUNTY, UTAH, CENTRAL PART NO. 20

Land division corners are approximately positioned on this map

N

(Joins sheet 19)

R. 1 E. | R. 2 E.

T. 8 S.

1 Mile 5000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

SURVEY

SOIL

DETAILED

OF

LIMIT

Benjamin

Central School

(Joins sheet 23)

(Joins sheet 25)

UTAH COUNTY, UTAH, CENTRAL PART NO. 22

Land division corner ... tates Department of Ag... and the Utah Agricultural Experiment Station

This map is one ...

(23)

(Joins sheet 20)

R. 2 E. | R. 3 E.

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 26)

and division corners are approximately positioned on this map.

UTAH COUNTY, UTAH, CENTRAL PART NO. 23

(24)

N

(Joins sheet 21)

R. 3 E.

T. 8 S.

Mapleton

SPANISH FORK

EAST BENCH CANAL

BENCH CANAL

LATERAL

DENVER AND RIO GRANDE WESTERN RAILWAY

UTAH SOUTHERN RAILWAY

MAPLETON BENCH

NATIONAL FOREST BOUNDARY

(Joins sheet 23)

(Joins sheet 27)

(Joins inset, sheet 27)

1 Mile

5000 Feet

Scale 1:20 000

UTAH COUNTY, UTAH, CENTRAL PART NO. 24

Land division corners are approximately positioned on this map

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station

UTAH COUNTY, UTAH, CENTRAL PART — SHEET NUMBER 25

UTAH COUNTY, UTAH, CENTRAL PART NO. 25

R. 1 E. | R. 2 E.

(Joins sheet 22)

T. 9 S. | T. 8 S.

(Joins sheet 26)

(Joins sheet 28)

Payson

Payson Station

Tanner Reservoir

Scale 1:20 000

1 Mile 5 000 Feet


N
(Joins sheet 23)
R. 2. E. | R. 3 E.
T. 9 S. | T. 8 S.
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 29)
Scale 1 20 000
1 Mile
5000 Feet
Payson
Salem
Salem Pond
Grandy Pond
Creek
CEMETERY
CANAL
SALEM
STRAWBERRY LINE
HIGH CANAL
DENVER AND RIO GRANDE
UNION PACIFIC
WESTERN
33
34
35
36
31
4
3
2
1
6
9
10
11
12
7

UTAH COUNTY, UTAH, CENTRAL PART NO. 27

N

R. 1 E. | R. 2 E.

T. 9 S.

(Joins sheet 25)

(Joins sheet 29)

(Joins sheet 30)

Payson

Walker Flat

Spring Lake

1 Mile

5000 Feet

Scale 1:20 000

UTAH COUNTY, UTAH, CENTRAL PART NO. 28

Land division corners are approximately positioned on t

d in 1970 as part of a soil survey by the United States Department of Agriculture Soil Conservation Service, and the Utah Agricultural Experiment Station

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station
Land division corners are approximately positioned on this map
UTAH COUNTY, UTAH, CENTRAL PART NO. 29

N

(Joins sheet 26)

R. 2 E. | R. 3 E.

T. 9 S.

Payson

16 15 14 13 18

21 22 23 24 19

28 27 26 25 30

Rocky Ridge

SALEM CANAL

STRAWBERRY CANAL

HIGH LINE CANAL

Payson Canyon

Loafer Canyon

(Joins sheet 28)

(Joins inset, sheet 31)

LIMIT OF DETAILED SOIL SURVEY

(Joins sheet 31)

1 Mile 5000 Feet

Scale 1:20 000

UTAH COUNTY, UTAH, CENTRAL PART — SHEET NUMBER 3

(3)

N

(Joins sheet 1)

R. 1 E. | R. 2 E.

T. 4 S.

(Joins sheet 2)

(Joins sheet 6)

Alpine

ALPINE CEMETERY

NELSON AQUEDUCT

NELSON DITCH

SALT LAKE AQUEDUCT

DETAILED SOIL SURVEY BOUNDARY

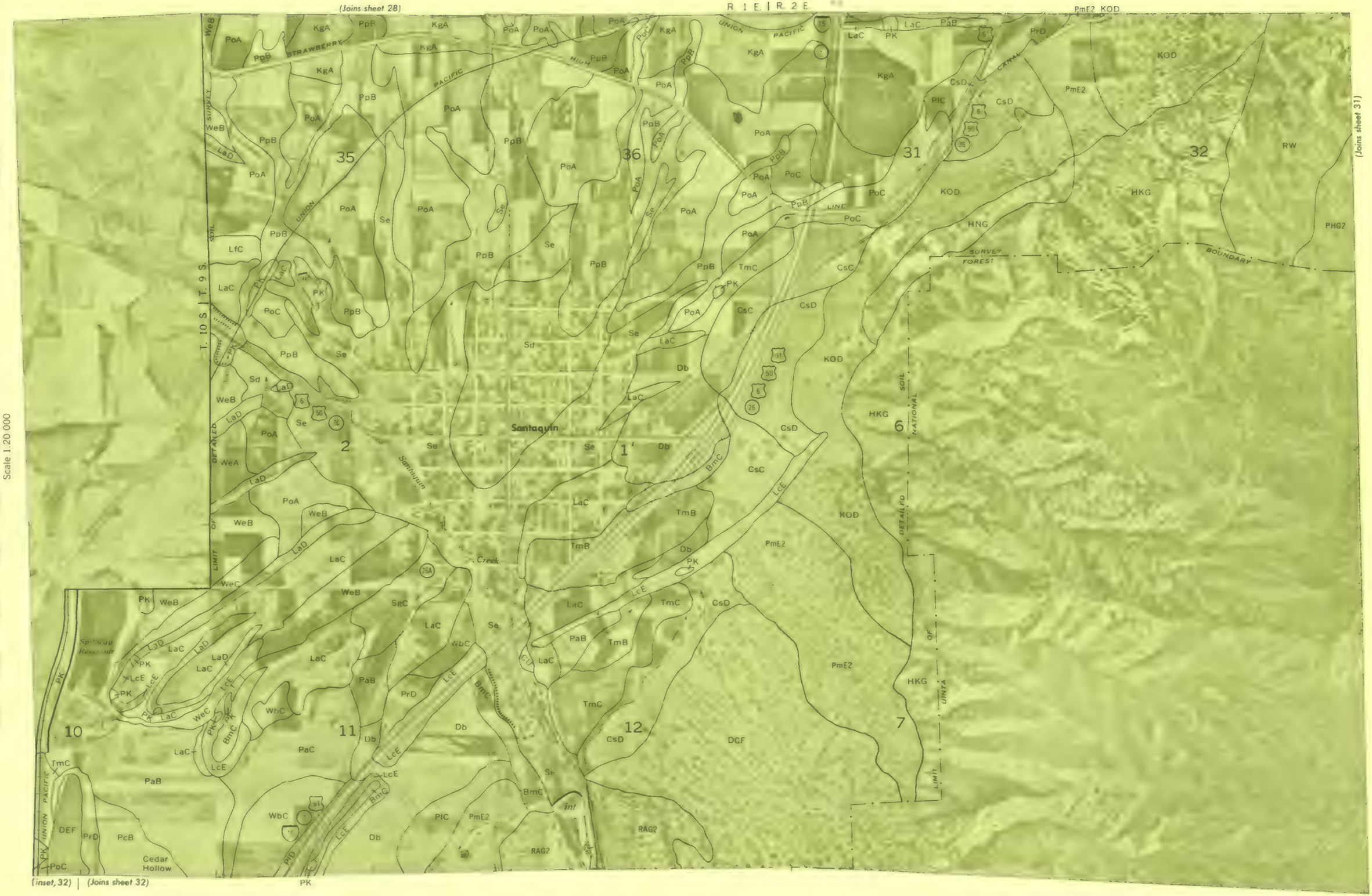
UINTA NATIONAL FOREST BOUNDARY

Scale 1:20 000

1 Mile 5000 Feet

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station
Land division corners are approximately positioned on this map

UTAH COUNTY, UTAH, CENTRAL PART NO. 3



UTAH COUNTY, UTAH, CENTRAL PART NO. 30

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station. ... positioned on ... corners, are approximately positioned ...

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station
Land division corners are approximately positioned on this map.

UTAH COUNTY, UTAH, CENTRAL PART NO. 31

R. 2 E.

(Joins sheet 29)

T. 9 S.

(Joins sheet 30)

RAG2 CrD PNG2 CrD GAG RW KOD MAF HFF RW PJG2 HKG GAG PAYSON Canyon MAF Intermittent Creek MAF HKG HKG CANYON 33 34 35 36 HFF PHG2 HFF PHG2 PHG2 HKG RW GAG RW GAG PJG2 Loafer SURVEY SOIL DETAILED LIMIT OF

UINTA NATIONAL FOREST BOUNDARY

(Joins sheet 27) R. 3 E.

PK PID PIC PaB BkB LaC LaD LcE TmB PmE2 CsD Da KOD GAG MAF 18 19 T. 9 S. SURVEY SOIL DETAILED LIMIT OF

(Joins inset, sheet 29)

(Joins inset, upper right)

(Joins inset, lower left)

CsD PmE2 19 KOD GAG HFF CrD 30 GAG Broad Hollow T. 9 S. SURVEY SOIL DETAILED LIMIT OF

(Joins sheet 29)

R. 3 E.

31

N

1 Mile 5000 Feet

Scale 1:20 000

N

1 Mile

Scale 1:20 000

0 1000 2000 3000 4000 5000

T. 10 S.

R. 1 E.

(Joins sheet 30)

(Joins inset, lower left)

(Joins inset, upper right)

Cedar Hollow

15

14

13

23

24

25

26

36

PrD PaB PaC PaE2 PoC PcB ReC WhD LaD BkB PK PID PmE2 Db BmC LEE DEF PIC RAG2 PIF DCF PHG2 DRG2 HEG RW GAG

Pole Canyon

Hillhouse Canyon

JUAB COUNTY

LIMIT OF DETAILED SOIL SURVEY

FOREST BOUNDARY

NATIONAL FOREST BOUNDARY

LIMIT OF UINTA DETAILED SOIL SURVEY

(Joins sheet 30)

(Joins upper left)

(Joins lower left)

UTAH COUNTY, UTAH, CENTRAL PART NO. 32

Land division corners ... of a soil survey by the United ...

(4)

UTAH COUNTY, UTAH, CENTRAL PART NO. 4

...of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station

Land division corners are approximately positioned on this map.
UTAH COUNTY, UTAH, CENTRAL PART NO. 5

5
N

1 Mile
5000 Feet

Scale 1:20 000
0
1000
2000
3000
4000
5000

(6)

N

(Joins sheet 3)

R. 1 E. | R. 2 E.

T. 5 S. | T. 4 S.

1 Mile

5000 Feet

Scale 1:20 000

(Joins sheet 5)

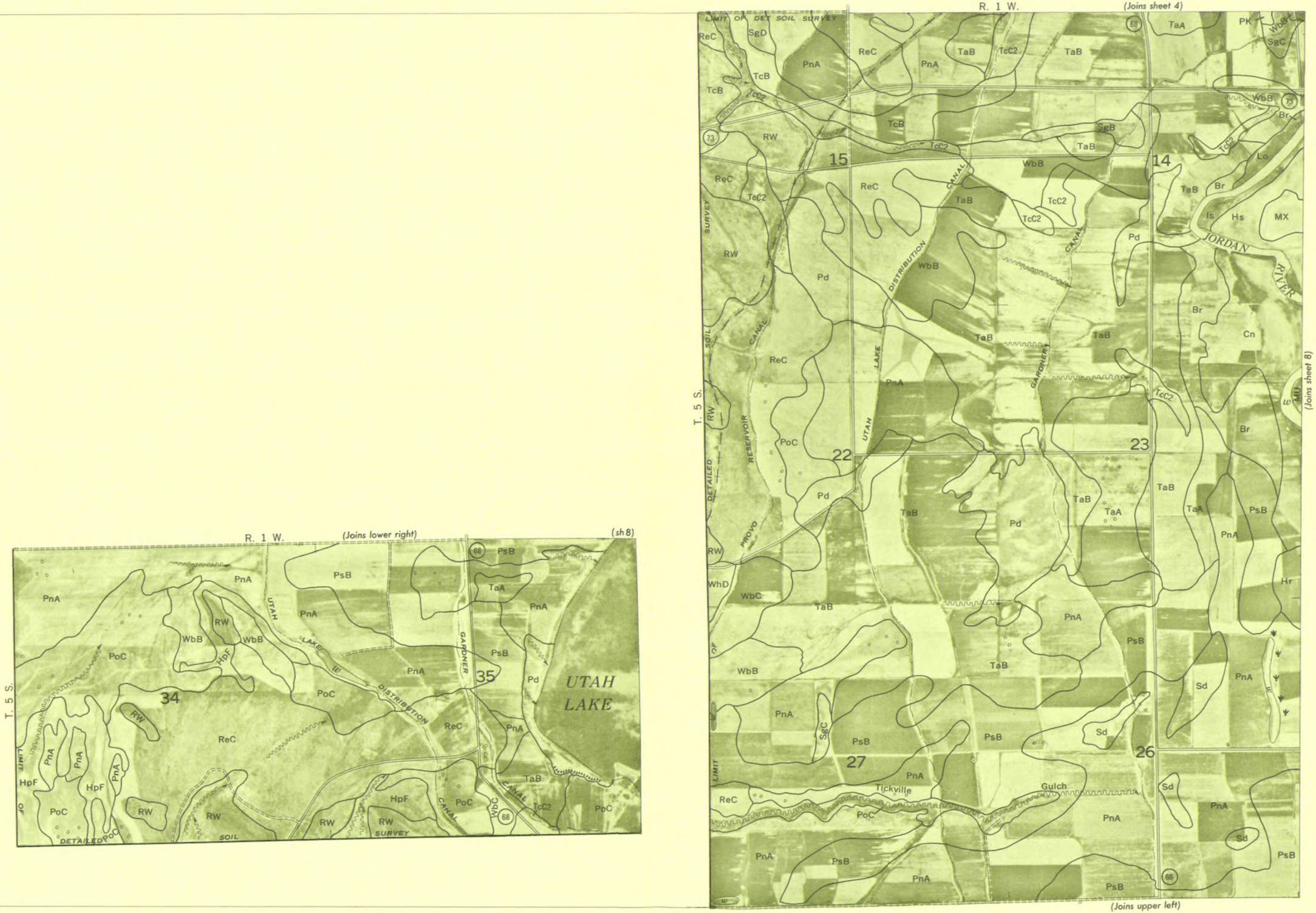
(Joins sheet 9)

American Fork Training School

UTAH COUNTY, UTAH, CENTRAL PART NO. 6

Land division corners are approximately positioned on this map

UTAH COUNTY, UTAH, CENTRAL PART NO. 7



8

N

(Joins sheet 5) R. 1 W. | R. 1 E.

T. 5 S.

(Joins sheet 7)

(Joins sheet 9)

1 Mile 5000 Feet

Scale 1:20 000

0 0

1 ¼ ½ ¾ 1

5000 4000 3000 2000 1000

Lehi

Saratoga Springs

U T A H L A K E

Jordan River

Creek

Dry Creek

Spring Creek

Mill Pond

Denver and Rio Grande Western

Union Pacific

13 18 17 16 15 24 19 20 21 22 30 29 28 27 25

UTAH COUNTY, UTAH, CENTRAL PART NO. 8

Land division corners are approximately positioned on this map

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station.

UTAH COUNTY, UTAH, CENTRAL PART — SHEET NUMBER 9

9

N

(Joins sheet 6)

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 11)

AMERICAN FORK

Pleasant Grove

UTAH LAKE

Wing

1 Mile

5000 Feet

Scale 1:20 000

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Utah Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

UTAH COUNTY, UTAH, CENTRAL PART NO. 9

UTAH COUNTY, UTAH, CENTRAL PART

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Dual
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State or county

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings

- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

BOUNDARIES

- National or state
- County
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line

- Perennial
- Intermittent

Streams, single-line

- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches (CANAL)

Lakes and ponds

- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

RELIEF

Escarpments

- Bedrock
- Other

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Wind hummock
- Saline spot
- Landslide or slip